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CORRECTION

The Editors regret that in Dr. Walter Pagel's paper in the April issue (The Philosophy of Circles—Cesalpino—Harvey, A Penultimate Assessment, pp. 140-157) some errors occurred in the Greek: in line 9, page 141 it should read (transcribed) "Haimatos Phora," and in footnote 2, same page—"Periodos, Periphora, Phora." The "not" should be omitted in line 4 of the caption to Figs. 1 and 2.

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The Organic Physics of 1847 and the Biophysics of Today*

PAUL F. CRANEFIELD**

"I cherish the firm conviction that the physico-mathematical research method correctly applied, is in a position to do a great service to organic physics."[1]

Emil du Bois-Reymond, 1848

THE great dream of Emil du Bois-Reymond and his famous colleagues, to found a new physiology consisting of biochemistry and biophysics, seems to have gone astray sometime during the last hundred years. Not only is biophysics springing up as a new science largely unaware of the goals or even the existence of the organic physics of 1847, but also it is largely springing up outside the main line of classical physiology. Since that main line was in great part established by the biophysicists of 1847, Carl Ludwig, Hermann von Helmholtz, Ernst von Brücke, and Emil du Bois-Reymond, it seems worthwhile to investigate the goals and fate of the 1847 program.

It is convenient to refer to these men as the 1847 group and to their program as the 1847 program. The basis for selecting this year is that in 1847 Ludwig became acquainted with the other members of the group. Brücke and du Bois-Reymond had been friends for years, and du Bois-Reymond and Helmholtz had met in 1845. The latter three were students of Johannes Müller. Ludwig, slightly older, had been a pupil of Ludwig Fick. Since the movement as a whole is identified with all four of its members and since most authors characterize it by quoting Ludwig's statement about the 1847 meeting in Berlin: "We four imagined that we should constitute physiology on a chemico-physical foundation, and give it equal scientific rank with Physics . . .,"[2] 1847 seems an appropriate date to attach to the movement. In mid-year of 1847 Ludwig was thirty and fairly well started on his career, having several important publications and holding an appointment as a.o. Profes-

* This paper won the 1956 Schuman Medical Historical Essay Prize.

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1 Emil du Bois-Reymond, *Untersuchungen über thierische Elektricität*, Berlin, G. Reimer, 1848, p. xxvi. Part of the Vorrede was republished by du Bois-Reymond in his *Reden*, and is better known in that context under the title "Über die Lebenskraft." All translations in this paper are my own unless otherwise indicated.

2 Quoted from Burdon Sanderson's "Ludwig and modern physiology" as reprinted in *Sir John Burdon Sanderson*, by Lady Burdon Sanderson, Oxford, 1911, p. 281.

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sor at Marburg. The others were still working with Müller. Brücke and du Bois-Reymond were 28 and Helmholtz was 26.[3]

The 1847 group expressed their views about the nature of physiology during the ten years centering around 1847. In 1841 du Bois-Reymond wrote "I am gradually returning to Dutrochet's view 'The more one advances in the knowledge of physiology the more one will have reasons for ceasing to believe that the phenomena of life are essentially different from physical phenomena,'"[4] and in 1842, "Brücke and I have sworn to make prevail the truth that in the organism no other forces are effective than the purely physical-chemical . . .,"[5] and in 1845, "I have made the acquaintance of Helmholtz. . . . This is (*sauf la modestie*) to Brücke and my humble self the third organic physicist in the group. A stout fellow who has lapped up chemistry, physics, mathematics, entirely sharing our philosophical point of view and rich in thought and new viewpoints."[6]

In 1848, in the preface to his *Untersuchungen über thierische Elektricität,* du Bois-Reymond discussed the problem in much greater detail. It was this book and its preface which, along with Ludwig's *Lehrbuch* of 1852, made the greatest contemporary impression as propaganda for the physical viewpoint. Adolf Fick refers, in his eulogy of du Bois-Reymond, to "the epoch making effect which the appearance of du Bois-Reymond's *Untersuchungen* had produced"[7] and goes on to say: "I still remember exactly the strong impression which that noteworthy book made upon me as a young student almost fifty years ago when my unforgettable teacher Ludwig handed it to me to report on in a physiological colloquium. One understands even today that this book must make an overpowering impression if one observes the monumental labor put into it and in particular realizes that here for the first time a broadly planned investigation of an extensive field of physiological phenomena was carried out in accordance with the most rigorous physical methods."[7]

In this preface we find such statements as that at the head of this paper and, "The true nucleus of the method, therefore, the

[3] These dates and much of the information on "geneologies" have been taken from K. E. Rothschuh, *Geschichte der Physiologie,* Berlin, Springer, 1953.

[4] Estelle du Bois-Reymond, *Jugendbriefe von Emil du Bois-Reymond an Eduard Hallman,* Berlin, Reimer, 1918, p. 98. Several of the following quotations are to be found in Owsei Temkin, "Materialism in French and German physiology of the early nineteenth century." *Bull. Hist. Med.,* 1946, *20,* 322-7. I am greatly indebted to this short but extremely suggestive paper.

[5] *Jugendbriefe,* p. 108.

[6] *Ibid.,* pp. 122-3.

[7] Adolf Fick, *Gesammelte Schriften,* Würzburg, Stahel, 1904, v. 3, p. 492.

root of the physical mathematical technique, lies . . . in the effort to determine the basic connections of the natural phenomena beneath the mathematical structure of their relationships,"[8] and the assertion that "it cannot fail that . . . physiology . . . will entirely dissolve into organic physics and chemistry. . . ."[9] Equally remarkable and entirely characteristic of its author is the statement: "I have succeeded, unless I am completely deceived, in awakening to vigorous reality, although in a somewhat altered form, that hundred year dream of physicists and physiologists of the identity of the nerve process [Nervenwesens] and electricity."[10]

The boldest statement of the absolute scope of the physical method is one which du Bois-Reymond spent the next few decades explaining, his famous remarks on the freedom of the will: ". . . those who are of one mind with me will not permit themselves to be shaken in the conviction, that nevertheless, if only our methods sufficed, an analytical mechanics of the general life process would be possible. This conviction rests on the insight, possessed even by Aristotle, that all changes in the material world within our conception reduce to motions. Therefore even that process cannot be anything but motions. But again, all motions may ultimately be divided into such as result in one direction or the other along the straight line connecting two hypothetical particles. Therefore to such simple motions must even the processes within the organic state ultimately be reducible. This reduction would indeed initiate an analytical mechanics of those processes. One sees, therefore, that if the difficulty of the analysis did not exceed our ability, analytical mechanics fundamentally would extend even to the problem of personal freedom. . . ."[11]

In his "Ueber die Grenzen des Naturkennens"[12] of 1872 du Bois included freedom of the will among the "transcendental" problems of which he said "ignorabimus." Still later, in "Die Sieben Welträtsel"[13] of 1880, he partially retracted his retraction, having been annoyed by the success of "ignorabimus" in the hands of people he disapproved of, and offered the more cautious "dubitemus." In terms of the goals of 1847 it is the initial sweeping assertion that is of interest, especially since it emphasizes the degree

8 *Untersuchungen,* p. xxix.
9 *Ibid.,* p. l.
10 *Ibid.,* p. xv.
11 *Untersuchungen,* p. xxxv.
12 Emil du Bois-Reymond, *Reden,* Leipzig, Veit, 1912, v. 1, pp. 441-73.
13 *Ibid.,* v. 2, pp. 65-98.

to which mechanistic explanation meant just that, explanation in terms of the motion of material particles.

Ludwig's view and practice at this time can be gauged from the frequently quoted first sentence of the *Lehrbuch* of 1852: "Scientific physiology has the task of determining the functions of the animal body and deriving them as a necessary consequence from its elementary conditions,"[14] and, "This summer I have again ridden mathematics very hard and become tolerably firm in the saddle, up to the partial integral equations (Francoeur). Now I shall study Poisson, in order next summer to resume my experiments on the flow in elastic tubes."[15] Ludwig had taken an anti-vitalistic position in his Habilitationschrift, before he had met the others of the 1847 group: "Rei peritos minime miraturos mihi persuadeo cur hisce pagellis de vi vitali haud multum disseratur, fusius contra conditiones physicae et chemicae illustrentur."[16]

In his eulogy of Ludwig, Fick summarizes the position of the 1847 group by saying that although certain isolated problems in physiology had been treated in a physical manner, by such men as E. H. Weber, Volkmann, and Müller, the 1847 group were the first to assert as a general law that "a vital phenomenon can only be regarded as explained if it has been proven that it appears as the result of the material components of living organisms interacting according to the laws which those same components follow in their interactions outside of living systems."[17]

This then was the program of 1847—in particular the program of Ludwig, the same Ludwig who was to become at Leipzig a father of modern physiology, the man who had more numerous and more influential pupils than any of his contemporaries or successors in physiology. How did physiologists feel about this program some eighty years later?

Writing in 1930, Fulton said:

. . . it is . . . possible to distinguish two main groups of investigators . . . in some respects opposed. There are those who cherish the independence of

[14] C. Ludwig, *Lehrbuch der Physiologie des Menschens*, Heidelberg, Winter, 1852, v. 1, p. 1. The sympathy between Ludwig and the other members of the 1847 group is emphasized by the fact that the *Lehrbuch* is dedicated to "Den Freuden E. Brücke, E. du Bois-Reymond, H. Helmholtz."

[15] Estelle du Bois-Reymond and Paul Diepgen, *Zwei grosse Naturforscher des 19 Jahrhunderts. Ein Briefwechsel zwischen Emil du Bois Reymond und Karl Ludwig*, Leipzig, Barth, 1927, pp. 27-28.

[16] C. Ludwig, *De viribus physicis secretionem urine dajuvantibus*, Marburgi, Cattorum, 1842, p. 1. Quoted from *Leben und Werk des deutschen Physiologen Carl Ludwig*, by Dr. Heinz Schröer. I am indebted to Dr. Schröer's kindness in sending me a typescript of his unpublished dissertation, and to his generosity in permitting me to quote from it.

[17] Adolf Fick, *Gesammelte Schriften*, Würzburg, Stahel, 1904, v. 3, p. 767.

physiology . . . they tend to set themselves apart under the designation 'general physiologist'. . . . Their viewpoint is quantitative and physical, and they seek to investigate 'vital' processes by restricting themselves to the methods of physical and electrochemistry. Their interest in many cases is centered upon fluids and substances derived from living things, rather than upon the living organism itself. The contribution to physics and chemistry of this relatively small group of workers has been great. . . .

There is another and larger group of physiologists who . . . feel that the true objective of their science is the human body. . . . It were perhaps better for science that many of the so-called 'general physiologists' recognize that they are not physiologists at all, and that it would be preferable to style themselves by more accurate descriptive terms such as "biophysicists,' 'protein chemists,' or 'electrochemists,' as the case may be. . . . Physiology has leaned heavily in the past upon the more exact sciences, . . . at present, however, physics and chemistry have outdistanced the students of vital function, and it is likely in the future that the bearing upon physiology of discoveries of physicists and chemists will be less immediate than in former times. . . . One hopes in the future that physiology will aim to treat of the organism as a whole.[18]

A viewpoint expressed in Germany in 1949 is also of interest. Dr. Heinz Schröer says: "Ludwig's research displayed a general characteristic . . . his physical viewpoint [Anschauung]. A purely mechanistically pursued biology would of course today no more be held up as an ideal. However, the method of today's physiology is in essence physical in the broader sense and must necessarily be so . . . . modern physiology has outgrown the mechanistic age."[19]

There is ample indication that during the last few decades physiologists in all countries have not considered the elucidation of molecular mechanisms, the dissolving of physiology into biophysics and biochemistry as their immediate practice goal. The publications to be found in the leading journals testify well enough to that point. As for the theoretical bias of modern physiology, it is still common to define physiology as the physics and chemistry of life and to assume that the mechanistic stand is correct. Nevertheless, a position sometimes called organicism holds a very wide popularity today: the position that is identified with the frequent use of such concepts as homeostasis, integration, adaptation, organization, and whole organism. These biological concepts are essentially neutral and descriptive but to some they carry a flavor of vitalism. This position is associated with Haldane, Barcroft, and Cannon, and is often represented, perhaps not quite correctly, as the position of Bernard. It is perfectly sound and scientific to con-

[18] John F. Fulton, *Physiology* (Clio Medica), New York, Hoeber, 1931, pp. 110-12.
[19] Heinz Schröer, *op. cit.* (see note 16), p. 78.

sider the problems of the whole organism, but the level of abstraction represented by the above terms is anything but mechanistic.

Among contemporary biophysicists the feeling is often found that it is difficult if not impossible to obtain biophysical training in physiology departments, partly because there is no one to give the training, partly because individual efforts to study mathematics and physics are viewed askance, and finally because where biophysics is encouraged, it is most often conceived of in terms of electronic instrumentation and work with radioactive tracers. It is not easy to document the above statement from printed papers, but it is very easy to do so by personal communication. It is certainly true that the men now recognized as biophysicists in this country have often been trained as physicists, and are working in departments of physics, in departments of biophysics, and in research institutes rather than in departments of physiology.

If we accept the thesis that in the last two or three decades physiology has not been enthusiastically receptive toward biophysics, it will immediately seem probable that the biophysics movement of today did not originate as a revival within physiology of the goals of 1847. We can gain further evidence for this, as for the similarity of the goals of today's biophysics to the goals of 1847 by turning to statements of modern biophysicists. "At the present time biology is overcharged with facts—indocile creatures which need that 'mysterious Priest' the mathematical physicist to lead them to the altar. . . . What prodigious services such a one can render is already abundantly clear. . . . The difficulty . . . is the want of courage in the physicist to come over the way, to leave his home in the physical laboratory and venture among strangers."[20] So was du Bois-Reymond echoed in 1930 by Sir William B. Hardy. A physicist tells how he was drawn into biophysics by the unexpected ease with which he solved a particular biological problem and says: ". . . I was quite sure at that time that the lack of progress of biologists and physiologists in their science was entirely due to the fact that they did not know how to apply the beautifully precise and quantitative measurements that we physicists knew about, and that all I had to do was enter the field and in a few years I could clear up the whole science for them."[21] In a semi-popular article Prof. Pollard says: "Perhaps the time is ripe for applying physics to biology. Can physical principles shed light on the phenomena

[20] Sir William B. Hardy, "Conclusion to the discussion on colloid science applied to biology." *Trans. Faraday Soc.*, 1930, *26*, 864.

[21] *Symposium on shock.* N. Y., Josiah Macy, Jr. Fdn., 1953, p. 21.

of life as they have on so many other fundamental questions? More specifically can the laws of quantum mechanics, electricity and statistics explain living systems?"[22] In his *Four Lectures on Biophysics* K. S. Cole remarks that in the history of the field one can find such men as Poiseuille, Mayer, Fick, Helmholtz, Maxwell, H. Weber, and L. Hermann. He names, therefore, one member of the 1847 group, Helmholtz, and two pupils, Fick, who was a pupil of Ludwig, and Hermann who was a pupil of du Bois-Reymond. He then remarks: "But now we may ask, what about the progress of biological physics in the present century? It has been limping along not getting much of anywhere not at all certain of where it is going. But perhaps it is not so much worse than it was in the 19th century—if we exclude Helmholtz, that is."[23]

If, as the above quotations suggest, modern biophyicists tend to be unaware of, or uninfluenced by the 1847 program, and if the physiological heirs to 1847 have tended to be unsympathetic to biophysics, the least we may conclude is that the 1847 group did not succeed in creating a movement toward biophysics at all comparable in influence to that attained by the sister science of biochemistry, and that even the impetus toward biophysical investigation diminished over the years. There are many obvious reasons why this should have been so, the most obvious and the most important being that the state of physical knowledge of 1847 was such as to make biophysics a decidedly premature venture. The dominant branch of physics was mechanics, the new fields were heat and electricity. Most of physical chemistry, biochemistry, thermodynamics, spectroscopy, and most molecular theories in physics lay in the future. Some of these sciences in fact grew out of the work Helmholtz did after he had largely abandoned physiology for physics.

One would naturally assume that the high goals of 1847, being unattainable, gradually fell from sight and were completely lost track of after the death of their propounders. As a matter of fact, the reaction seems to have set in much sooner as is shown by various statements of Adolf Fick. Fick was a pupil of Ludwig and a strong adherent of all of the goals of 1847. Not only that, but he, more than any of the members of the 1847 group, made some progress toward those goals. His work on diffusion (Fick's Law), on muscle contraction, on muscle thermodynamics, and on blood

22 E. C. Pollard, "The physics of viruses," *Sci. Amer.*, Dec. 1954, p. 63.

23 K. S. Cole, *Four lectures on biophysics.* Instituto de Biofisica, Universidade do Brasil, Rio, 1947, pp. 9-17.

flow (Fick's Principle) represents some of the finest achievement in pure and applied biophysics in the nineteenth century. When he speaks of biophysics he does not do so unsympathetically.

In 1874 Fick[24] pointed out that twenty-five years earlier a remarkable development had occurred. The concept that the phenomena of life were to be explained in chemico-physical and physico-mathematical terms had been introduced and gained absolute ascendency. Trail-blazing discoveries of the forties and early fifties, such as those made in studying the electrical and chemical phenomena in nerve and muscle, in combination with the successful use of mathematics in a number of applied problems (the mechanics of the circulation, the mechanism of the ear, the dioptrics of the eye) had had a brilliant success. Not only young men but also research workers grown grey in other pursuits turned to the study of mathematics in order to do justice to the new orientation. No one could doubt that from that time onward all physiologists would be thoroughly trained in physics and mathematics.

But "the absolute dominance of the mechanistic-mathematical orientation in physiology has proved to be an Icarus flight, and unhappily in this case, the wax of the wings was not melted by too great a nearness to the sun of knowledge but through the heating which the unaccustomed effort brought with it."

Fick pointed out that the mechanistic explanation of vital processes still received acceptance as the ultimate goal of physiology, but the immediate daily research in 1874 was directed to practical problems: the question of which nerves innervate the heart or blood vessels was receiving as much attention as the problem of the molecular nature of the nerve impulse. Many workers who were strongly oriented toward the physical approach in 1850 had by 1874 turned to other methods of study, e.g. histological. This Icarus flight Fick attributed to the extreme difficulty of both theory and practice met with in the biophysical realm. Few were able or willing to take the time to learn physics and mathematics. The young physician "imagines mathematical studies, for one provided with the necessary rudiments ought to be just as easy as medical studies are for an accomplished physician." On the laboratory side, the physically oriented experiments are far more difficult than ordinary vivisections or histological researches. "Considering this

[24] Adolf Fick, "Methoden und Richtung der physiologischen Forschung" in *Gesammelte Schriften*, v. 4, pp. 389 ff. The following three paragraphs are freely translated and condensed from Fick. Where quotation marks are used exact translation has been carried out.

great difficulty which progress in the mechanistic direction offers, it can be no surprise if it is no more as generally taken up as it was in the time when it added the stimulus of novelty to the attractive force which it always through its nature must exert on logical minds."

Years later, in dedicating his institute at Würzburg Fick said that of the three sections, vivisectional, chemical, and physical, the smallest space was "for my own research orientation—the physical" and explained this by the fact that the need for space is determined more by the amount of instruction than the amount of research and "In physically oriented physiological practical courses a large crowd cannot be expected. Lively interest for this experimental orientation presupposes a degree of mathematical and physical development which the students of medicine . . . only very exceptionally are able to gain."[25]

This evidence for the Icarus flight and downfall of the biophysical movement in Germany correlates very well with our other observations. In particular, if the biophysical approach died down as a practical working approach as soon as Fick implies, then we see that it was quite possible for physiologists from the United States to work with Ludwig in the 1870's,[26] and even to become disciples of Ludwig, without partaking of the extreme biophysical philosophy but only of the physiological working approach. Incidentally, Ludwig was famous for matching the problem to the student and would certainly not have forced a physical problem on a person unprepared for it. Thus there is nothing to cause surprise when we find American physiology many years later thinking of itself as descendant from Ludwig and at the same time holding rather cool views toward the biophysical and even the general physiological approaches. Similarly, we find that the most ardent biophysicists of the next generation were pupils during the early, ambitious years of the 1847 program: in particular Adolf Fick, Julius Bernstein, and Ludimar Hermann. It is worth noting that these men became well known for their research in the two fields in which almost pure biophysics has continued to be of importance in classical physiology to this day, the fields of the nature of muscular contraction as studied mechanically and thermodynamically, and of the nature of the nerve impulse as studied electrically. These

[25] Adolf Fick, "Rede Zur Einweihung des Physiologischen Instituts in Würzburg." Mai 1888. *Loc. cit.*, v. 4, pp. 486-96.

[26] George Rosen, "Carl Ludwig and his American Students." *Bull. Hist. Med.*, 1936, *4*, pp. 609-50.

areas have always, when treated physically, seemed on the verge of revealing their secrets, and for the last hundred years physiologists with physical interests have been drawn to them. They naturally represented the stronghold of the 1847 group.

A quite separate problem is posed by the field of general physiology. This discipline, which could logically have been the bridge between the biophysics of today and that of 1847 but in general was not, requires an entire study in its own right. The whole question of the relation of the goals of general physiology to those of the 1847 movement, of the attitude within the field toward the problem of the reduction of physiology to physics and chemistry, and the associated philosophical question of whether or not general physiology represents a valid level of abstraction between that of physiology *qua* physiology and physiology *qua* physics and chemistry is very complex. Some of the names prominent in this field are those of men academically descended from 1847, e.g. Jacques Loeb was a pupil of Adolf Fick, and Christian Bohr was a pupil of Ludwig and the teacher of Krogh. On the other hand Höber is found, again with Jacques Loeb, among the pupils of Goltz, of whom Rothschuh quotes Ewald as saying, "He was and remained a biologist in the period when people wanted to reduce physiology to applied physics and chemistry."[27] Anyone who wishes to be satisfied that the general physiology which was becoming popular before the first world war was quite different from the 1847 movement need only glance at Loeb's *The Mechanistic Conception of Life*[28] with its emphasis on parthenogenesis and tropisms, or at the prefaces to the various editions of Bayliss' *Principles*[29] to see how biological much of the conceptualization was and how far removed from the spirit of du Bois-Reymond's *Vorrede*.

To gain a more detailed impression of the nature of the scientific activity of the 1847 group it is convenient to consider its members individually with reference to biophysics and physiology. Ernst Brücke is today the least well known of the four, although du Bois-Reymond runs him a close race for this distinction. Neither is likely to be mentioned in a course in physiology even if it is taught by someone interested in the history of the field. Only Helmholtz and Ludwig are represented in the magnificent portrait gal-

[27] Rothschuh, *op. cit.*, p. 187.

[28] Jacques Loeb, *The mechanistic conception of life*, Chicago, University of Chicago Press, 1912.

[29] Sir William Maddock Bayliss, *Principles of general physiology*, 4th ed., London, Longmans, Green, and Co., 1924. The 4th edition retains the prefaces to the preceding three editions.

lery included in Bayliss' *Principles,*[30] nor does Bayliss even credit Brücke with one of his more important investigations, and one of a biophysical nature—the observations on the singly and doubly refractive bands in skeletal muscle. Rothschuh finds only twelve contributions of Brücke of sufficient importance to be included in his tables[31] and of these perhaps only the one mentioned above is biophysical. Others are biochemical, such as the demonstration of a reducing substance in normal urine and the preparation of crystalline pepsin. But the general picture of his research is physiological. As a matter of fact the most famous of Brücke's pupils, Sigmund Freud, spent most of his time with Brücke working on histological problems.[32] Brücke had some successful students, e.g. Cyon and Kühn, but none of his followers can be considered strongly physically oriented.

With du Bois-Reymond the situation is quite different. Of the four, he remained the most faithful to biophysics throughout his life and trained well-known students with a physical orientation, in particular Ludimar Hermann and Julius Bernstein. It is natural that electrophysiology, the life work of du Bois-Reymond, should remain physically oriented. It can hardly be otherwise. What is not so obvious is why he remained faithful to electrophysiology. His great contributions, the discovery of the negative variation of activity in nerve and muscle (i.e., the action potential) were made by 1849 and it is almost not too harsh to say that he did little of value thereafter. Adolf Fick speaks movingly of his success, influence, and failure: "The last of the four great founders of the German physical-physiology school . . . the representative man of the physical school. . . ." "One understands that this book [the *Untersuchungen*] would be regarded as a prototype, and throughout decades was considered as such and that people had placed on it the most sanguine hope that the explanation of the electromotor activity of muscle and nerve would in the near future permit the solution of the riddle of life." "However, in spite of all expenditure of acumen and effort he did not succeed as he had hoped 'to awaken that hundred year drama of physicists and physiologists to vigorous reality.' On the contrary he had to experience the general abandonment of the theory which he had so fondly con-

30 Bayliss, *op. cit.*

31 K. E. Rothschuh, *Entwicklungsgeschichte physiologischer Probleme in Tabellenform,* München-Berlin, Urban & Schwarzenburg, 1952.

32 Siegfried Bernfeld, *Psychoanal. Quar.,* 1944, *13,* pp. 341-62. *Amer. Imago,* 1951, *8,* pp. 107-27.

ceived and which had originally been accepted with enthusiasm by his colleagues. Du Bois-Reymond to the end was not persuaded by his opponents. It was rather tragic to see how so great a personality fought with all the means of his rich spirit for an early adopted and tenaciously held theory against grounds whose soundness must readily be evident to every unprejudiced person."[33]

Du Bois-Reymond's own judgment is no more cheerful. The *Untersuchungen* was published over a period of thirty-six years, Volume I appearing in 1848, Volume II, part 1 in 1849, Volume II, part 2, pages 1-384 (ending in the middle of a sentence) in 1860, and Volume II, part 2, pages 385-579 in 1884. Twenty-four years seems rather a long time to finish writing a sentence, but in fact much of the last section had already been printed in 1860, and the author says in the Nachwort of March 1884, "So I have at last decided, with heavy heart, to stop where I might just as well have done more than a quarter-century ago. . . . These *Untersuchungen* remain a torso, or even more, a *Monstrum per defectum*. . . ."[34]

The book remained a torso because of the author's inability to write the final section, promised in 1848, "In the fourth section I have allowed myself to discuss certain conjectures on the relation of electrical phenomena of nerve and muscle with the rest of the phenomena of their activity."[35] The impossibility of writing a general theory of electrophysiological activity even today, and Fick's opinions, merely emphasize the fact that du Bois-Reymond, by sticking faithfully to purely biophysical problems ensured that his earliest work was his best and ensured a decline in his once gigantic reputation to its present-day low state. Du Bois-Reymond wrote *finis* to his long attempt to explain electrical events in tissues three years before Arrhenius introduced the concept of the ion into chemistry. Ostwald suggested the possible connection between ionic distributions and electrophysiological phenomena in 1890 when du Bois-Reymond was seventy-two. We see here again the basic difficulty of the 1847 search for a pure physics and chemistry of life, a seeking for molecular explanations in a day when physics and chemistry were predominantly molar.

The greatness of Helmholtz lies partly in the fact that he gave up biophysics and physiology to become one of the greatest physicists of all time. As a physicist he laid the foundation for much of the thermodynamics and physical chemistry that was to play so im-

33 Fick, see note 7.
34 Du Bois-Reymond, *Untersuchungen*, v. II, part 2, p. 501.
35 *Ibid.*, v. I, p. liv.

portant a role in the general physiology and biophysics of the future. Indeed, from the thermodynamics of Helmholtz to that of Ostwald and van't Hoff and from there to the Bernstein membrane theory and the electrochemical theories of excitation which have, in the hands of Hodgkin, raised new hopes of solving the now two-hundred-year-old "dream of physicists and physiologists" there is a very direct line indeed. But if we consider Helmholtz strictly as a biophysicist, we find the usual story: the great contributions were pretty well over by the time the "program" was formulated. Between 1847 and 1852 he contributed the law of the conservation of energy, with its implications for animal heat, the measurement of muscle heat, the measurement of the conduction velocity of the nerve impulse: quite enough to set him up as a great biophysicist. Most of his subsequent work in physiology was on sensory problems and cannot be denied the title of biophysics, but most people would call it applied biophysics, a distinction which must be made in some of Ludwig's work as well. His work on vision and hearing, profound and physically oriented though it was, did not elucidate and did not aim to elucidate molecular mechanisms. Helmholtz did not fall into the error of du Bois-Reymond of continuing to hope that nineteenth century physics and chemistry were sufficient to provide molecular explanations. Perhaps this was so simply because he was so much more able a physicist and mathematician. At any rate the member of the 1847 group best qualified by ability and training to fulfill its goals of reducing physiology to physics and chemistry instead made his greatest contributions in physics and chemistry as such. Nonetheless, the accomplishments listed above and the profundity of his work give him fair claim to being known as one of the greatest physiologists of all time, equalled in the nineteenth century only by Bernard.

Ludwig, a figure of great versatility, whose labors in mathematics testify to his earnest desire to reason physically, is always thought of as the physiologist par excellence, the physiologists's physiologist. His career began with a physically oriented study, the filtration theory of urine formation. He had some biophysically oriented pupils, in particular Fick. Never at any time in his career was physically oriented work completely absent from his laboratory—work on filtration, diffusion, blood pressure, hemodynamics, blood gases appears and reappears. He stood fast by his mechanistic philosophy throughout the years. And yet—and correctly—he is thought of as a physiologist, often as *the* physiologist. Many physi-

ologists who recognize the superior ability of Helmholtz feel that somehow Bernard and Ludwig are the representative men of the nineteenth century.

We need only examine the purely physiological contributions of Ludwig to find the basis for this feeling: he introduced the kymograph and the recording manometer, he studied the depressor nerve and demonstrated reflex slowing of the heart, he studied the function of the vasomotor center and the splanchnic nerves, elucidated the nature of Traube's waves, worked on secretion and the secretory nerves, studied the heart sounds and cardiac excitability, automaticity and fibrillation. We may also examine the publications of the Leipzig Institute and find the occasional physically oriented paper balanced by the occasional purely anatomical paper, the rest—the majority—being typical, elegant, modern physiology in reasoning and method.

It is especially interesting in considering Ludwig as a biophysicist to look at the German physiologists of 1930 in *Minerva,* make a list of the most obvious candidates for the title of biophysicist and find that the top contenders are not pupils of the 1847 group: Höber, Cremer, and Frank. Rothschuh remarks that Frank did not like Ludwig and left his institute for that of Voit. It is especially striking that this modern representative of the rigorous physical treatment of cardiovascular problems left Ludwig, dissatisfied. The rigorous and severe physical-mathematical orientation did not dominate the institute of the "genial" Ludwig or the work of Bowditch, Pavlov, or many other great physiologists of the next generation who were pupils of Ludwig.

Rothschuh claims that the shift to a Physico-chemical orientation in physiology occurred not with Müller but with Ludwig.[36] It cannot be claimed here that the shift never occurred at all, but it can be suggested that the influence of the 1847 group is better understood in terms of what we now call the scientific method and that the great growth of physiology in the nineteenth century was a result of active experimentation rather than the result of success in reducing physiology to physics and chemistry. Never at any time did any member of the 1847 group succeed in reducing a vital phenomenon to physics and chemistry. A general survey of their work might divide it into physiology and applied biophysics, where by applied biophysics is meant the use of physical devices or measurements in physiological problems. Most of du Bois-Reymond's work

[36] *Op. cit.,* p. 119.

in electrophysiology comes under the category of applied biophysics, as does much of Helmholtz's, especially the work on the physics of vision and hearing. The measurement of the heat produced by an active muscle, or of the conduction velocity of a nerve impulse, though elegant technical achievements are applied physics not molecular explanation.

It is important to remember that the use of physical techniques and modes of thinking was not introduced into physiology by the 1847 group. It had been part of physiology at least since Borelli, and even as this group met in Berlin in 1847 physics had been actively and successfully applied to physiology for two decades by such a man as E. H. Weber. We cannot set the 1847 group aside and honor them for introducing the ideas of weighing and measuring and reasoning physically into physiology. What they did do was proclaim as an article of faith the idea that physiology could be reduced to physics and chemistry and they proclaimed their intention to do it. It was this proclamation which won them so much attention and it was this intention which they failed to carry off. Indeed, it is not possible today to give an explicit and detailed reduction of any complex physiological phenomenon in terms of physics and chemistry.

The attempt to explain the life process in terms of physics, chemistry, and mathematics fell from grace during a time when physiological knowledge was increasing sensationally. Even if we regard all of du Bois-Reymond's work and some of Ludwig's and Helmholtz's as biophysical, the contributions to physiology *qua* physiology of this group represent an enormous development in the field, a development founded primarily on the techniques of histology and vivisection. Rothschuh characterizes the earlier part of the nineteenth century (Müller, Magendie) as experimental, biological, and vivisectional, and the era of Ludwig as physical-chemical. A survey of all the evidence suggests that the great success of the 1847 group was based on methods which may justly be called experimental, biological, and vivisectional, rather than on a theoretical bias toward the physical and chemical. Because the announced program of the 1847 group was physical and chemical and because the 1847 group were so successful as physiologists, it does not follow that they were successful in terms of their own goals.

The introduction of certain devices such as the galvanometer, the use of certain measurements, such as that of blood pressure, does not argue for a biophysical triumph. Had the movement of

1847 been really successful and productive in biophysical terms, it would, as Fick implies, have continued to draw young men trained in physics and mathematics and it would have seized at every new advance in physics and chemistry. In fact, the kymograph remains a symbol of physiology today. There can be no doubt that a considerable and important change in the direction of physiology *qua* physiology occurred around 1850, an infusion of physical thinking and methodology. There is equally little doubt that the infusion found the science biological and left it biological. In all probability the progress made in experimental physiology in the period 1850-1950 owes as much or more to the use of anesthesia in vivisection as it does to the application of physics and chemistry.

Another aspect of the 1847 movement which was of great importance in its success and influence and which stemmed directly from its philosophical opinions was its vigorous anti-vitalism and determinism. The assertion of du Bois-Reymond's *Vorrede* that the explanation of life processes must be sought in the ordinary laws of inorganic nature is an important belief for the experimentalist because of its implication of causality, and more than that, of accessible causality. Although purely mechanistic research methods can be used by a quasi-vitalist such as Haldane or by a man indifferent to the philosophical problems involved, such as Weber, at least a firm belief in causality is indispensible. As Helmholtz said in 1869, "In physiology particularly scientific work had been crippled by doubts respecting the necessary conformity to law, which means, as we have shown, the intelligibility of vital phenomena, and this naturally extended itself to the practical science directly dependent on physiology, namely medicine. Both have received an impetus, such as had not been felt for thousands of years, from the time that they seriously adopted the method of physical science, the exact observation of phenomena and experiment,"[37] and, "The attack was made wherever a way could be perceived of understanding one of the vital processes, it was assumed that they could be understood, and success justified this assumption."[38]

The mechanistic assertions of 1847 had a triple implication: firstly, the anti-vitalist position, with its accompanying idea of intelligible causality; secondly, an argument for the use of observation and experiment; these two implications formed the basis for

[37] Hermann von Helmholtz, "The aim and progress of physical science" (1869) in *Popular lectures on scientific subjects,* trans. by E. Atkinson, London, Longmans, Green, 1898, v. 1, p. 345.

[38] Helmholtz, "On thought in medicine," *op. cit.,* v. 2, p. 224.

the progress made by the group.[39] The third implication, that it was practical and worth attempting to reduce physiology to physics and chemistry, was of value in drawing attention to the other two. If the scientific practice of the 1847 group is considered in terms of the first two implications, it will be seen to have a great deal in common with the practice of its predecessors such as Müller and Magendie, Purkinje, and Weber, with Bernard and with modern physiology. The apparent discontinuity in the realm of theory is seen to be just that—philosophical assertion, of the utmost importance, of necessity relegated to the position of a remote goal.

The 1847 group was vastly successful in experimental physiology, temporarily successful in putting across mechanism as against vitalism, and reasonably successful in popularizing applied physics and chemistry as techniques in physiological research. But Ludwig, Helmholtz, du Bois-Reymond and Brücke had for a short time held most of German physiology to a much bolder task, that of dissolving physiology into physics and chemistry. It was this task which Ludwig himself admitted proved "much more difficult than we had anticipated."[40]

[39] Compare Paul Bert on Bernard: "I must repeat that Claude Bernard, therefore, proved himself, almost from the outset, superior to both Magendie and Bichat, since he felt not only the endless multiplicity of unknown data in physiology, but also their subordination to the general laws of matter and their obedience to the experimental method." Quoted from Bernard, *An introduction to the study of experimental medicine*, trans. by H. C. Greene. New York, Macmillan, 1927, p. xiv.

[40] See note 2.

The Anemograph of Ons-en-Bray:

An Early Self-Registering Predecessor of the Kymograph With Translations of Original Description and a Biography of the Inventor *

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INTRODUCTION

THE kymograph holds a place of unquestioned preëminence in the history of physiology. It epitomizes the fruitful union of physics, engineering, and technology in the service of biology and medicine, not because it was the first application to them of the growing instrumentation of physical science, but because it added to the physical measurement of physiological parameters by appropriate devices the features of permanent graphic recording for subsequent analysis.[1]

The modesty for which Carl Ludwig, its inventor, was noted, and his preoccupation with strictly physiological problems in the original paper describing the kymograph, and thereafter, have deprived us of any personal account of how this fertile combination of smoked drum and mercurial manometer was conceived, constructed, and placed in use. His pupils, who brought the kymograph to every research and teaching laboratory of physiology in the world, and introduced it into pharmacology, medicine, and more specialized fields, and who might have heard an account of it from the master himself, have all failed to record it for us if they ever knew it.

Marey, however, makes it clear that the basic principle of the kymographic system—self-registration, by which the event to be studied so to speak writes on travelling paper its own account of the changes it undergoes with the passage of time and experimentally induced alterations—was not new. Known or unknown to Ludwig, an instrument of the same type had in fact been in use in meteorology almost a hundred years before the description of the kymograph, and had been reported to the scientific world in a remarkable account of a self-recording anemometer by Louis Léon Pajot, Count of Ons-en-Bray (1734). This unique instrument employed a clock-work paper-drive to record graphically the velocity and direction of the wind over a 30-hour period. Records were calibrated by independent time marks every fifteen minutes. Ingenious devices regulated paper tension and stylus pressure, and accessories were constructed to facilitate analysis of records

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[1] Ingenious and important contributions to the art of instrumentation as it is applied to physiology had been made by Swammerdam, Boyle and his school, Fontana, Galvani, the brothers Weber, and many others. The kymograph was unique, however, in many respects, not the least important of which was that it made the collection of data a completely objective process free from personal bias.

No account of this instrument appears to exist apart from its original description. This neglect of an important forerunner of recording instruments in meteorology as well as physiology is alone ample reason for publishing a translation of the original memoir on the anemometer and an account of its inventor's life. More than this, by good fortune this venerable instrument has been preserved, to give testimony of the accuracy with which it was described, the ingenuity of its design, and the competence of its execution.

The interest this instrument holds for physiologists, and its place in the history of instrumentation, are not at all diminished by the certainty that even this ancient machine was not the first of its line, and the priority must be given, if to no one earlier, to Christopher Wren and Robert Hooke.[2] If indeed Ludwig had predecessors in the more general applications of self-registering devices, and even if some echoes of their work came to help him in his problems in physiological instrumentation, they were indeed worthy predecessors, and detract nothing from the credit that is his for single-handedly bringing automatic recording to physiology.

The life of Ons-en-Bray as translated here is from his Eulogy, traditionally accorded deceased members of the Academy of Sciences, and delivered by Jean-Paul Grandjean de Fouchy, permanent secretary of the Academy of Sciences about whom brief mention may be made in passing because of his authorship of the Eulogy.

De Fouchy was born in Paris in 1707 and died there on 15 April 1788, at the age of eighty-one. He showed talent as a poet while a youth and composed throughout his life. He displayed more than average skill with several musical instruments. A small fortune left to him by his father permitted him to devote part of his life to a position as auditor and the rest to science. He was elected to the Academy of Science as an astronomer in 1731 and contributed regularly to its memoirs. He was named perpetual secretary in 1743 and held this position for thirty years, being responsible for the official eulogies of departed members. He imparted to these eulogies a tone of frankness and good faith which gained the confidence of his listeners and which is apparent in the Eulogy translated here.

Ons-en-Bray's description of the anemograph, literally translated, now follows. The numbers in parenthesis refer to the figures and are part of the original text. The superscriptions are our explanatory notes. The formal, rather stiff, style of the author is apparent in the translation.

ANEMOMETER,

which by itself marks on paper, not only the winds which have blown during the 24 hours, and at what time each has started and stopped, but also their different velocities or relative strengths

Navigation and windmills each day procure for us very considerable advantages, which we owe to the means that have been devised for profiting by the impulsion of the air or the force of the wind, which is such a strong force, and which costs us nothing to maintain. We could derive even greater advantages of this force

[2] Clockmaking contributed much to this invention; the Roman clepsydra approached the kymograph within a hair's breadth. Robert Hooke contributed the anchor escapement of the clock and the hair-spring of the pocket watch to this art, and the skill of the clockmaker is apparent in almost every detail of Ons-en-Bray's anemometer. The technical language of his description is replete with the terminology of clock-making.

if we knew it better; thus I thought that it would be very useful to find machines which would put us in the position of measuring better than it has been done up to now the relative force of the wind, which could even lead us to learn its absolute force.

It would not be less essential to know all the varieties of winds in different countries, also; many authors have written about their origin and the causes of their varieties.

Chancellor Bacon, in his History of Winds,[3] after having spoken of the origin, of the causes, and the variety of winds, calls attention to the necessity of having observations in different countries; but he says nothing about the means which could be employed to make these observations.

Captain William Dampier,[4] the Englishman, at the end of his second volume of the Voyage Around the World, has given a treatise on winds which reign throughout the torrid zone; it is very useful for great sea voyages.

All that one finds, either in Rohault[5] or in Mariotte,[6] are

[3] Francis Bacon (1561-1620), Baron Verulam, Viscount St. Albans, and Lord Chancellor of England from 1618 to 1620. His influence on the founding of the Royal Society is well recognized, and undoubtedly this body's interest in meteorology stemmed from his *Historia ventorum* first published in 1622. William Harvey was his physician and said of him that "he writes Philosophy like a Lord Chancellor." This charge of fustiness is hardly borne out by his introduction to the History of the Winds: "To men the winds are wings. For by them men are borne and fly, not indeed through the air but over the sea, a vast gate of commerce is opened, and the whole earth is rendered accessible."

[4] William Dampier (1651-1715). Navigator on a grand scale, he thrice circumnavigated the globe, and proved that New Britain and New Guinea were separate islands. His account of his voyages in two volumes became the most popular travel writing of his period because of its wealth of adventure, its exotic background, and the sense of immediacy it imparted. Ons-en-Bray refers here to the second volume, *Voyages and discoveries*, first published in 1699. Part III of this volume is entitled: "Capt. Dampier, his discourse on the Trade-Winds, Breezes, Storms, Seasons of the Year, Tides and Currents of the Torrid Zone throughout the World." (Dampier, William. *Voyages and discoveries.* London, Argonaut Press, 1931. 35 + 311).

[5] Jacques Rohault (1620-1675). Son of a rich merchant, his inventive spirit led him while still a student to frequent the workshops of Paris in order to study instrument-making and to devise means of perfecting them. He became an adherent of the school of Descartes and married the daughter of Clerselier, Descartes' publisher. Physics was his favorite study, and he devised a form of barometer to demonstrate the weight of the air. His great reputation as a teacher aroused jealousy and he was accused of professing dangerous doctrines, a charge which harassed him even on his death-bed. He was buried next to Descartes in the church of St. Geneviève in Paris (The Pantheon). His *Traité de physique*, published first in 1671, was long a classic in France.

[6] Edme Mariotte (?-1684). Celebrated French physicist who lived almost all his life in Dijon as prior of the Church of St-Martin-sous-Beaune nearby. He was a member of the Academy of Sciences from its beginning, and it was said of him by Condorcet that "It was Marioette who was the first in France to bring to Physics a spirit of observation and doubt, and who inspired that scrupulousness and the cautiousness so necessary to those who interrogate Nature, and who undertake to interpret her answers." In France he is best known for "Mariotte's Law"; "The temperature remaining the same, the volume of a given mass of any gas is inversely proportional to the pressure it supports," which in the Anglo-Saxon world is usually ascribed to Boyle. He is less well known as the discoverer of the "blind-spot." His collected works were first published in Leyden in 1717, and again at The Hague in 1740.

nothing but general explanations on the nature and physical causes of the origin and of the varieties of winds.

Recently we have had a dissertation on the causes and variations of winds by Father Sarrabat, a Jesuit, which gained the prize at the Academy of Bordeaux in 1730. But as all these reflections or dissertations have as their principal object theory more than practicality, which can gain but little advantage from them, I believed I could do nothing better to prove the certitude of this than in constructing five different machines, of which each one has certain particular advantages in use, to serve as proof of that which we propose.

The first, that we call a "lever anemometer" (anémomètre à levier) will indicate the relative force of the wind. We shall speak in its description of an anemometer described by Monsieur Wolff and of that which George Leutman has proposed.

The second, which we call "spindle anemometer" (anémomètre à fusée) will indicate the absolute force of the wind.

By the third machine, which is a type of balance, one could weigh, in a manner of speaking, the absolute force of the wind or the force of its impulsion on the surface of a square foot.

The fourth is made for the use of navigation, in order to know on a vessel the velocity or the force of the winds on the sails.

We reserve for our special assemblies the description and usage of these four machines, which time does not permit me to give, and which have furnished us different means to confirm and to assure ourselves of the precision of the fifth machine which is the object of this memoir.

This anemometer which we call "clock anemometer" (anémomètre à pendule)[7] is composed of two portions which are driven by the hour wheel of the clock A[8] placed between the two, which runs for 30 hours. That which is the most singular about this anemometer is that one does not need to remain in its presence for observation and that one finds marked on the paper all the changes that have occurred, either in the direction or in the velocity of the wind, the time of these changes, and the duration of

[7] In French, *pendule*, referring to weight, not *pendulum*. The motive power is furnished by suspended weights which in falling turn the gear-train of the clock. The rate of movement of the clock is regulated by an escapement. The term *pendule* has become a generic name for clocks, just as the English word itself has become generalized from the French "clocks," describing those that strike the hours on a bell.

[8] This letter and all following letters and numbers in the text refer to parts of the apparatus illustrated in the original figures, which are here labelled Figs. 1-6, and were plates 5-10 in the original; there are, however, no references to plate numbers in the original and the reader must locate the parts for himsellf. Our own notes are all superscriptions.

each wind. One will see for example at what time a wind began to blow, its name or its direction, its relative velocity, how long it continued, and how much time passed without there having been any wind. Finally we have attempted to make this anemometer more perfect and more useful than all those which have been proposed until now, and to such an extent that it instructs us about all that we could have need or desire to know regarding the winds. It can be placed in a room or a cabinet, where it would be an ornament, wihtout one's being obliged to keep it in the open.

DESCRIPTION

The Anemometer operates by means of three different motors.[9] The first is an ordinary clock marking seconds and operated by weights, placed in the middle, whose hour wheel engages with two wheels (1) and (2)—one of which is on the right and the other on the left—by means of which two cylinders or spools (3) and (24), to which they connect, each make two revolutions per hour.

The second motor, which is situated on the right, is a long rod (4) projecting the length of the wall above the roof, carrying a weathervane of such a size that a small force of wind will make the rod turn; it is important to choose locations where the direction of the wind upon the weathervane will not be interrupted by heights greater than that of the weathervane.

This rod at its lower end enters a cylinder marked (6), the base of which is an inch and a half in diameter and the height five to six inches. This cylinder carries from top to bottom 32 pins for the purpose of inscribing the 32 directions or rhumbs of the wind.[10] Since this part is important, these are the details of its construction.

We divided the circumference of the base of the cylinder (6) into 32 equal parts, in such a way that the division of each base matched each other exactly, and we drew straight lines from one point to the other upon the surface of the cylinder; having done this, we divided all these lines, or the height of the cylinder, into 32 equal parts by means of circles parallel to the base of the cylinder.

Having chosen one of these vertical lines as the first, a point was marked at its extremity; the intersection of the second line and

[9] In French, *moteurs*. The literal translation is a good term in physics and engineering, though not in general use. It refers to the three motive forces and their transmission to the recording system: the force of gravity moving the paper and registering time via the clockwork, the direction of the wind via the weathervane and machine C, and the velocity of the wind via the windmill and machine D.

[10] In both French and English a *rhumb* is one of the points of the mariner's compass.

the first circle from the top designates the 2nd point, that of the 3rd line and the 2nd circle denotes the 3rd point and thus are the rest to the 32nd point, for the 32 directions of the wind.

The path of all these points forms upon the cylinder's surface a spiral or helix (7) much like the turns of a screw; these are pierced with a hole in order to fit into them one end of the pins[11] and to keep them from dislodging.

Each pin is attached at its midpoint to the end of a small spring 9 to 10 lines in length,[12] and these springs are held in place upon the surface of the cylinder by two screws. One of these screws holds the end of the spring fixed; and the other, screwing it more or less into the cylinder, serves to regulate the proper distance to which the other end of each pin, which serves as a stylus,[13] must be separated from the cylinder in order to slide and mark upon the paper without tearing it.

There are behind the cylinder (6) three other cylinders marked (3), (8), and (9), or spools placed in triangular pattern between the two plates of machine C.

A long band of paper, 5 to 6 inches in width, and 18 to 20 feet in length is first wrapped around the vertical spool marked (3) and this band passes over the surface of cylinder (8) to be inscribed by the points of cylinder (6) which touch it, and finally rolls itself around spool (9).

The time required for all of the band of paper to be unrolled from one spool upon the other is about thirty hours.

It is the movement of spool (3) which regulates the release of the paper to roll itself upon spool (9). This movement is governed by the turning of an axle which has a wheel fixed at each end; the wheel marked (1) having 16 teeth engages with the hour wheel of the clock A, and the other marked (10) having 32 teeth, engages with wheel (11) of 16 teeth, which is attached to spool (3); in this way this spool (3) makes two revolutions an hour just as spool (9), at the top of which is another wheel (12) which meshes into a crown gear[14] with (13) a cord and a weight to keep the paper always under tension.

[11] In French, *cheville*. This is not the sharp-pointed household "pin," but a metal peg with a rounded blunt point.

[12] In French, *ligne*. The twelfth part of an inch.

[13] In French, *crayon*. We have used the word *stylus* to avoid the implication that the *crayon* actually deposited a colored matter on the paper chart. In all probability it marked by indentation.

[14] In French, *roue de champ*. A gear having its teeth at right angles to the plane of the gear, and hence parallel to its axis of rotation.

Although the revolutions of spool (3) are carried out in an equal amount of time—because it is governed by the hour wheel of the clock—each revolution nevertheless furnishes an unequal length of paper, according to whether there is more or less of it around this spool.

In order to remedy this inconvenience which would prevent recognition of the time when a particular wind commenced, its direction and its termination, we placed upon the top plate, marked E, a hammer which is raised by a double spiral cam attached to the end of spool (3), and which strikes a blow every quarter hour against a point which makes a hole at the top of the paper; thus one will have the length travelled by the paper in equal time divisions, that is at each quarter hour, which can be divided into half quarters, or even into minutes, without appreciable error.

USE OF MACHINE C

One must, in the first place, orient the anemometer, or know the rhumb of the wind toward which it will be turned. Let us suppose here that it is to be placed facing West, and the weather-vane is facing to the East, as if it were being blown by a West wind; the needle of the dial, which will designate the West, and the first spring-point of the cylinder (6) will touch the paper; thus this 1st point in this case will be the one which will always mark West upon the paper; and in general the 1st point will always mark the rhumb of the wind toward which the machine will be turned: if it were turned to the North, the 1st point would mark the North.

The second point will mark the next rhumb, going from West to South; thus in turn all the other points will mark the other directions of the wind in the same order from top to bottom, or from bottom to top.

One or two points always rub against the paper: these points will not tear it, being rounded and polished at the tips, and pressing against it only as much as one wishes to give tension to the springs upon which they are attached.

As the paper runs along, the point which touches it traces a straight line, and in order that the tracing be clearly visible, the paper should have been rubbed with Hartshorn powder, calcined and well pulverized; in this way each tracing will be like a pencil mark which can easily be erased, in order that the paper may be used several times.

This method of preparing the paper is extremely advantageous; we adapted it ourselves from M. Winslow, and it can conveniently be used for pocket writing tablets.[15]

The machine being set up as we have just explained, and put into use, one will find, so to speak, all which will have taken place, in writing upon the paper, the time and duration of each wind which blew, and generally all the variations in winds which will have taken place for 30 hours.

For 1, the time being marked upon the paper, as we have said, at each quarter hour, one will know the moment when a particular point began to mark upon the paper, or the beginning of a particular wind.

2. The length of the tracing made by a stylus upon the paper will designate the duration of this wind.

3. If two points wrote upon the paper simultaneously, this will signify that the wind has been between these two quarters of a rhumb, the result being that one will know thereupon the half quarters of the rhumb, or the winds upon the 64 divisions of the horizon.

4. If several points wrote, the wind will have covered several rhumbs.

5. If the winds have made, as one says, a trip around the dial, all the points will have marked in turn, and the time of all the changes will be known.

In order to find easily the name of the wind corresponding to each point, we have had a ruler (14) made which presents 32 teeth the same distance from each other as those which form the tracings of the 32 points; the names of the winds are written opposite each tooth so that one has only to place this ruler upon the paper from top to bottom in order to know immediately the name of the wind marked upon the paper; this ruler very much resembles a comb.

In order to determine also, with facility, the duration of the tracings, since each tracing which marks the duration of the wind rarely begins and ends at points which designate quarter hours, and as the intervals are unequal, we have made a proportional ruler in order to be able to divide immediately, into 15 minutes, the unequal distances of the quarter hours: this ruler marked (47)[16]

[15] The actual process employed here, and what it accomplished, eludes us. Was a deposit left by this process to be rubbed off by the styli? Or did it simply produce a matte finish, which, when rubbed smooth by the stylus, showed up as a shiny line? What was the color of calcined, pulverized Hartshorn?

[16] A proof-reader's error. Should be 43.

is made in the form of an isosceles triangle, truncated by a scale divided into 15 minutes, the same as the scale forming the base. These two scales are parallel; they are in length the greatest and smallest distances upon the paper of the points which mark the quarter hours, and we have stretched silk threads from one division to the other. It is evident that these silks will divide all the intervals lying between the greatest and the smallest. Thus with this scale one can ascertain almost to the minute the instant when a particular wind commenced and terminated.

It remains for us at present to give the description of the third motor and its effect upon machine D, in order to know the force and the relative speed of the wind.

This motor F which always turns in the same direction, whatever wind there may be, is a horizontal windmill, commonly called Moulin à la Polonaise, which is placed upon the roof.

The axle of this windmill is long enough to extend through to the upper storey, to keep a pinion which is at the end of this axle out of the rain and snow.

The pinion marked (15) which has 21 leaves, engages with wheel (16) with 84 teeth, whose arbor carried an endless thread (17) which drives wheel (18) with 100 teeth; thus the pinion carried by the axle of the windmill makes 400 revolutions in order to have the wheel with 100 teeth make one revolution; the axle of this same wheel of 100 teeth has a needle which marks the number of revolutions of the windmill from 1 to 400, upon a fixed dial marked (19). We have also employed a spiral cam (20) against wheel (18) in order to raise lever (21) which falls back at each 400 revolutions of the windmill; we will see the usage of this latter upon machine D, which we are going to describe.

This machine is placed at the left of the clock; it is in part like machine C, which we have just described; it carries, similarly, three cylinders or spools.

Upon the 1st spool on the left, marked (22) is rolled a band of paper 18 to 20 feet long, and an inch and a half wide: this band of paper passes over spool (23) and finally rolls itself upon spool (24), going, as the one in machine C, from left to right. The time which the complete band takes to pass from one spool upon the other is about 30 hours; this movement is regulated as that of machine C, by the revolution of an axle having one wheel at each end, of which one, which has 16 teeth and is marked (2) engages with the hour wheel of the clock, and the other (25) which has 32

teeth (26), with 16 which is attached to spool 24, in order to have it make one revolution in a half hour.

The axle of this spool is traversed below by a long pin marked (27), which in turning raises, at each half revolution or at each quarter hour, a pointer (28) by its tongue[17] which is on an inclined plane, this falling as soon as the pin leaves the tongue of the pointer, marks an inscription at the bottom of the band of paper at each quarter hour: in this way, the paper is found divided into equal intervals of time, by points from quarter-hour to quarter-hour and at an equal distance as on the paper of machine C.

Lever (21) which is placed near the windmill, and of which we have just spoken, raises by means of a cord or a brass thread, a small hammer (29); and as this lever falls back when the arm which lifts it has made its revolution, which happens, as we have said, at each 400 revolutions of the windmill, this hammer in falling strikes upon a pointer (30) which marks a point at the top of the band of paper; thus the number of revolutions of the windmill is marked at the top of the paper by points at each 400 revolutions, and each quarter hour being likewise marked by a point beneath, it will be easy to know by the number of points that there will be at the top of the band of paper, from one quarter hour to the next, how many times the windmill will have made 400 revolutions, and by the distance from one point to the next, one will know the following:

1. If the force of the relative velocity of the wind has been steady.

2. A larger number of points in the space which makes a quarter hour denotes that the more there are of them, the greater the force of the wind has been.

3. As there is always one of the points of cylinder (6) which marks the paper of machine C, whether there is wind or if there is none at all, one will consider the tracing as zero during all the quarter hours, or during the time that there will be no points marked at the top of the small strip of paper of machine D.

A force or velocity of a particular wind being indeterminable except by a number of repeated experiments, although we have already performed numbers of them, we propose to continue them in order to give us greater assurance; we will give them with the description of the other anemometers which we mentioned at the beginning of this memoir.

[17] Actually, *queue*, or tail.

Before concluding, I must observe that it is appropriate to have two machines like those marked C and D, so that there will always be two of them ready and supplied with their papers, in order to substitute them for the two others which would be removed at the end of 24 hours when the clock is rewound. It is always necessary to take care in marking at the beginning of each paper, what time it is on the clock, in order to determine, by comparing the two papers, all the varieties, or changes in direction, the duration and relative velocity of winds, of which one can make a register or journal, like the daily log of pilots.

One will, for example, mark in a first column the hours of the day, in the 2d column the names of the winds which will have occurred, in the 3d their duration, in the 4th the number of revolutions of the windmill, in order to have relative velocities, etc.

One can add to these observations those of the Barometer upon the weight of the air, and even those upon the temperature of the air in heat and in cold, in dryness and humidity by the Thermometer and the Hygrometer.

Physicists know the relations which all these things have to each other and how, so to speak, they are dependent one upon the other.

Observations made in different lands and above all in seaports, will be very advantageous; one will be in a position to make a history of winds, comparing terrestrial winds to marine winds, information which can influence navigation; and perhaps there could result from all these observations, illumination and more certain ideas to enhance our knowledge of the cause and the origin of winds and other metereological phenomena.

NAMES OF THE PARTS COMPOSING THE CLOCK ANEMOMETER

A. Ordinary clock for hours, minutes, and seconds.
B. Wind dial.
C. Machine at the right of the clock, to determine the direction and duration of the wind.
D. Machine at the left of the clock to determine the relative force of the wind.
E. Superior plate of machine C.
F. Horizontal windmill.

1 and 2. Wheels of 16 teeth each, driven from the right and left by the hour wheel.
3. Cylinder or spool driven by wheel 1.

4. Long rod which extends through the wall to reach the roof, and which carries above weathervane 5, and below the cylinder 6.
5. Weathervane.
6. Cylinder which carries 32 styli to mark on the paper the 32 directions of the wind.
7. Helix or spiral formed by the 32 styli on cylinder 6.

8 and 9. Cylinders or spools over which passes and rolls the paper of machine C.

10. Wheel of 32 teeth on the same axle as wheel 1, which engages with wheel 11 of 16 teeth.
11. Wheel of 16 teeth fixed to spool 3.
12. Wheel fixed at the top of spool 9.
13. Crown gear driven by wheel 12.
14. Ruler or comb to determine immediately the name of the wind.
15. Pinion of 21 leaves fixed to the axis of the windmill.
16. Wheel of 84 teeth driven by pinion 15.
17. Endless screw on the axle of wheel 16.
18. Wheel of 100 teeth driven by the endless screw.
19. Fixed dial divided in four hundredths.
20. Spiral cam on wheel 18.
21. Lever lifted by cam 20.
22. First spool, on the left of machine D, on which there is rolled at first the narrow strip of paper.
23. Middle spool over which the paper passes.
24. Spool on which the narrow strip of paper rolls up.
25. Wheel of 32 teeth, fixed on the same axle as wheel 2, which is driven by the hour wheel.
26. Wheel of 16 teeth fixed on spool 24.
27. Pin which lifts the tongued pointer 28.
28. Pointer with a tongue at an inclined plane.
29. Hammer which strikes every 400 turns of the windmill.
30. Pointer which serves to mark, at the top of the narrow strip of paper, a point for every 400 revolutions.
31. Slides with screws to advance or withdraw cylinders 8 and 24.[18]
32. Pointer of machine C.
33. Pointers carried by cylinders 3 and 24 which indicate minutes on dials 34.
34. Dials, divided into minutes.

[18] A proof-reader's error. Should be 23.

35. Double spiral cam carried by cylinder 3 to cause hammer 36 to strike every quarter-hour.
36. Hammer which strikes its blow every quarter-hour.
37. Spindles on which are wrapped the cords which support the weights to hold the papers under tension.
38. Weights.
39. Superior plate of machine D.
40. Pinion gear on top of spool 22 which engages the crown gear (41), fixed on the axle of spindle 37.
41. Crown gear.
42. Cords which hold the paper tense by means of weights.
43. Proportional scale for determining the minutes of duration of winds.
44. Wheel of 30 teeth fixed at the base of spools 3 and 24, to hold the paper in place on the exchange machines, by means of a latch.

[*End of Translation*]

THE FIGURES

The original text gives no individual description of the figures. A few explanatory notes may be helpful:

Fig. 1 (plate 5). Full-face view of the anemometer. Rods from the windmill F and weathervane S are foreshortened to show their relation to the machine. Not mentioned in the text are the take-off gears by which the needle of the wind-dial is turned. This train, seen better in Figure 2, is driven by a horizontal spur gear turned by the main weathervane. This gear engages a crown-gear facing backward. This in turn drives a third crown-gear whose axle extends into the clock where, as seen in Figure 3, it turns the pointer on the wind dial. At the upper right is a profile of the tension device for cylinder 8, over which the paper passes, and which gives counter pressure to the styli on cylinder 6. Cylinder 8 does not appear in this illustration, being obscured by cylinder 6, but is clearly seen in Figure 4.

Fig. 2 (plate 6). The assembly as seen from above and the left. The weathervane assembly is more clearly depicted and paper is in place. From the text it is clear that the broad strip of paper on the right is actually pulled out by the weight and pulley system, and that the central clockwork simply regulates its release. On the contrary, in the velocity recorder on the left, the clockwork mechanism actually winds up the paper against the restraint of the weights at the extreme left.

Fig. 3 (plate 7). Profile of the clock mechanism below and of the wind-dial above.

Fig. 4 (plate 8). The anemometer seen from the rear. This view visualizes cylinder 8, which gives counter-pressure to the paper so that the recording styli of drum 6 may bear with adequate tension on the paper. It

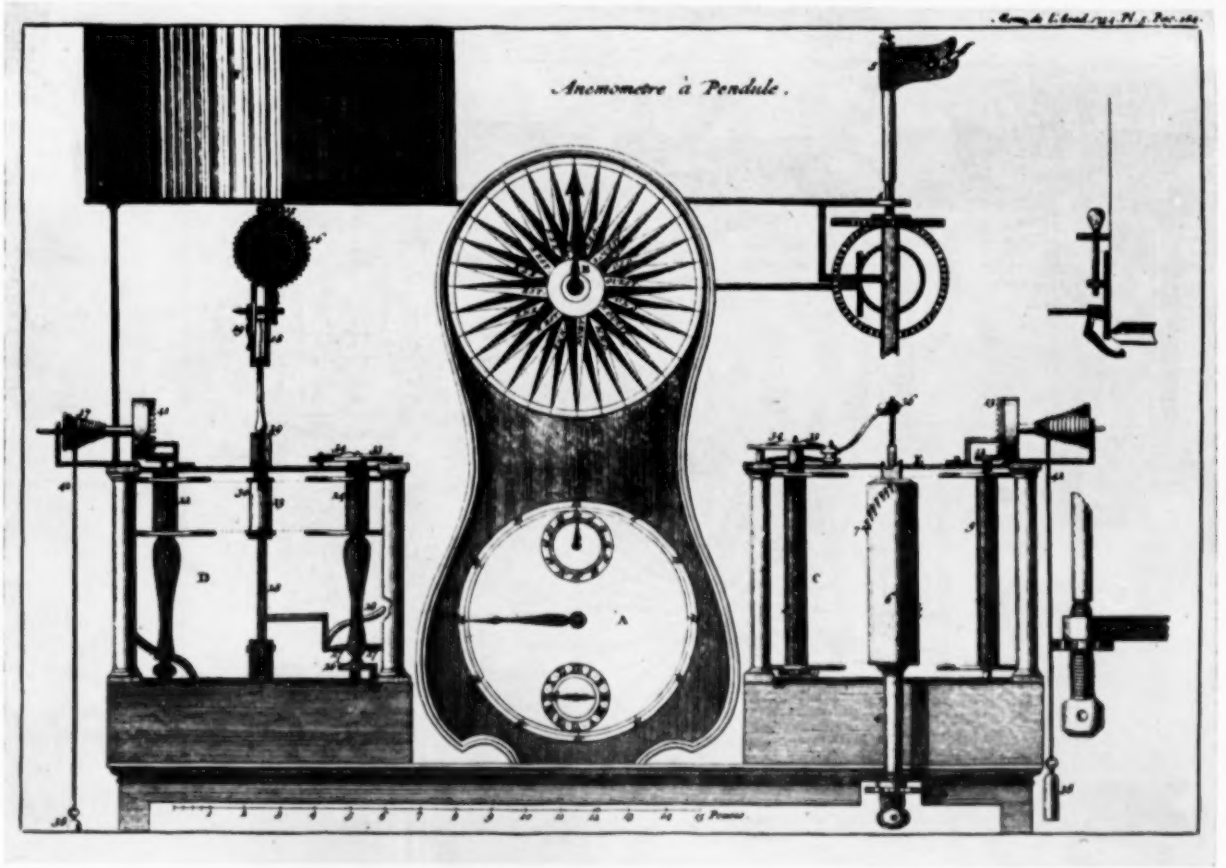


FIG. 1.

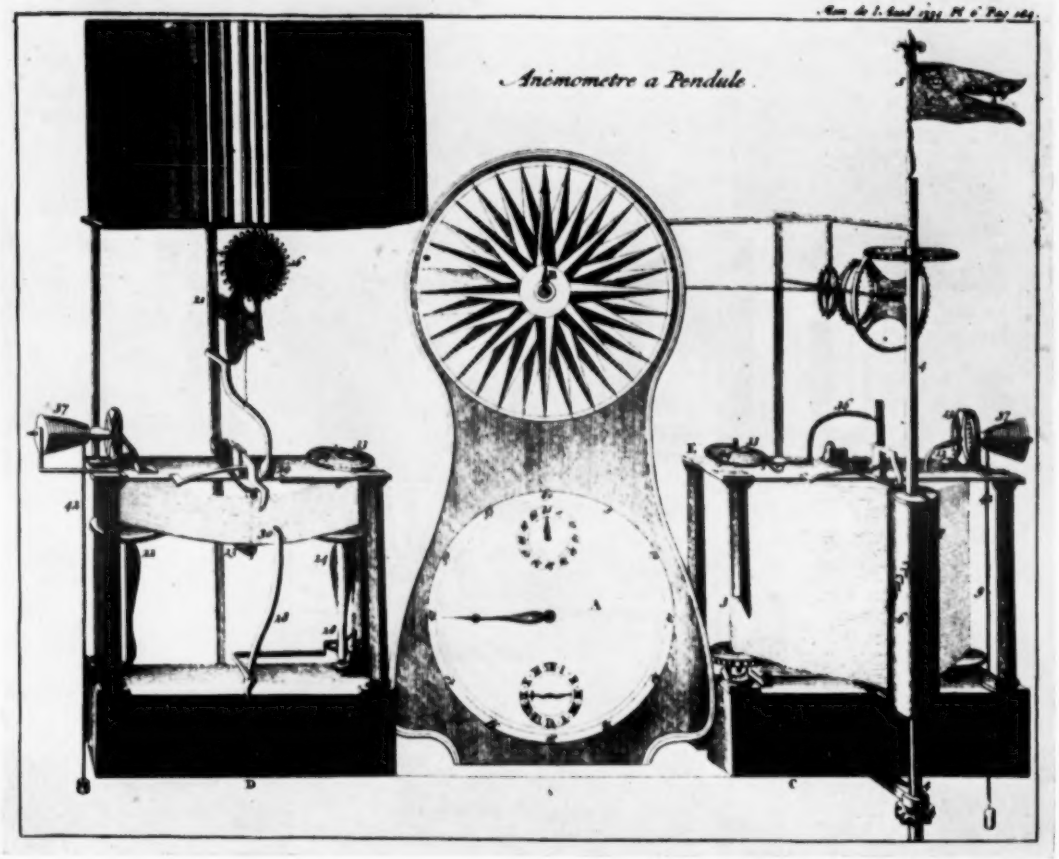
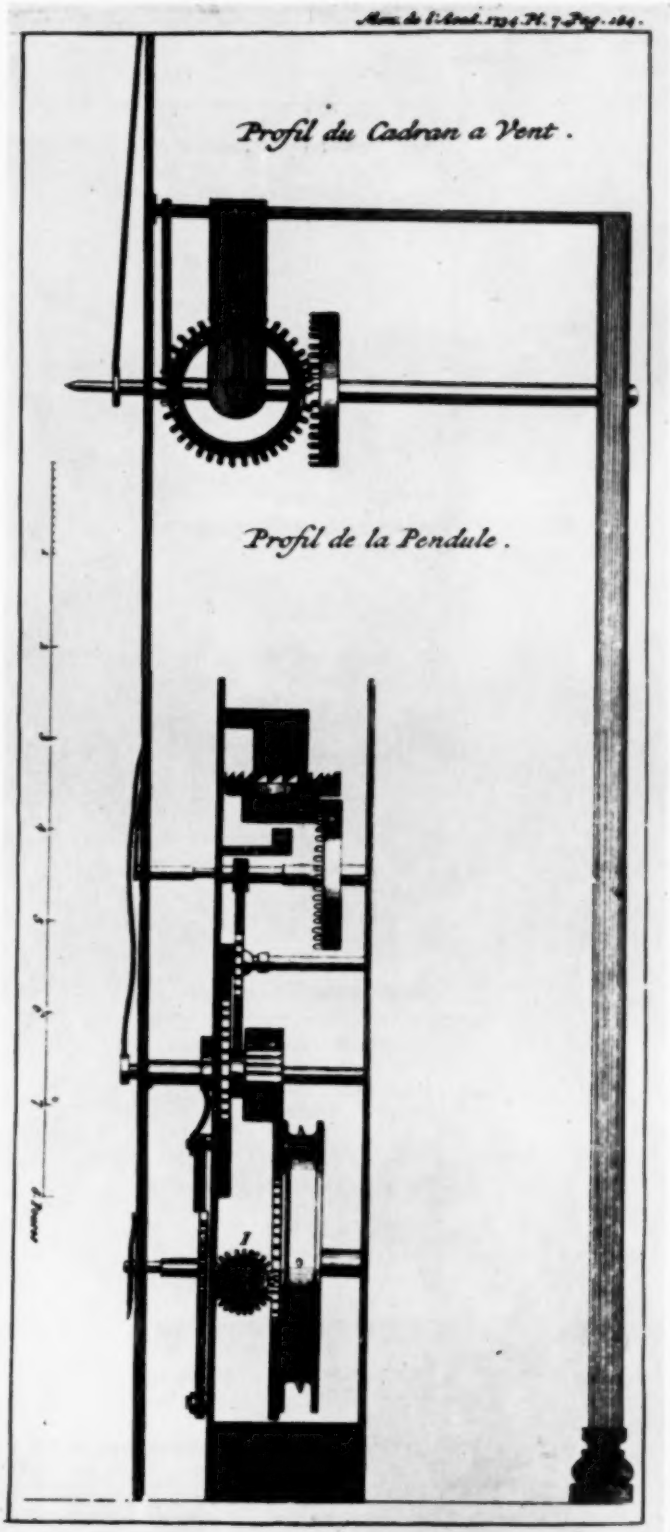


FIG. 2.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Profil du Cadran a Vent.
Profil de la Pendule.
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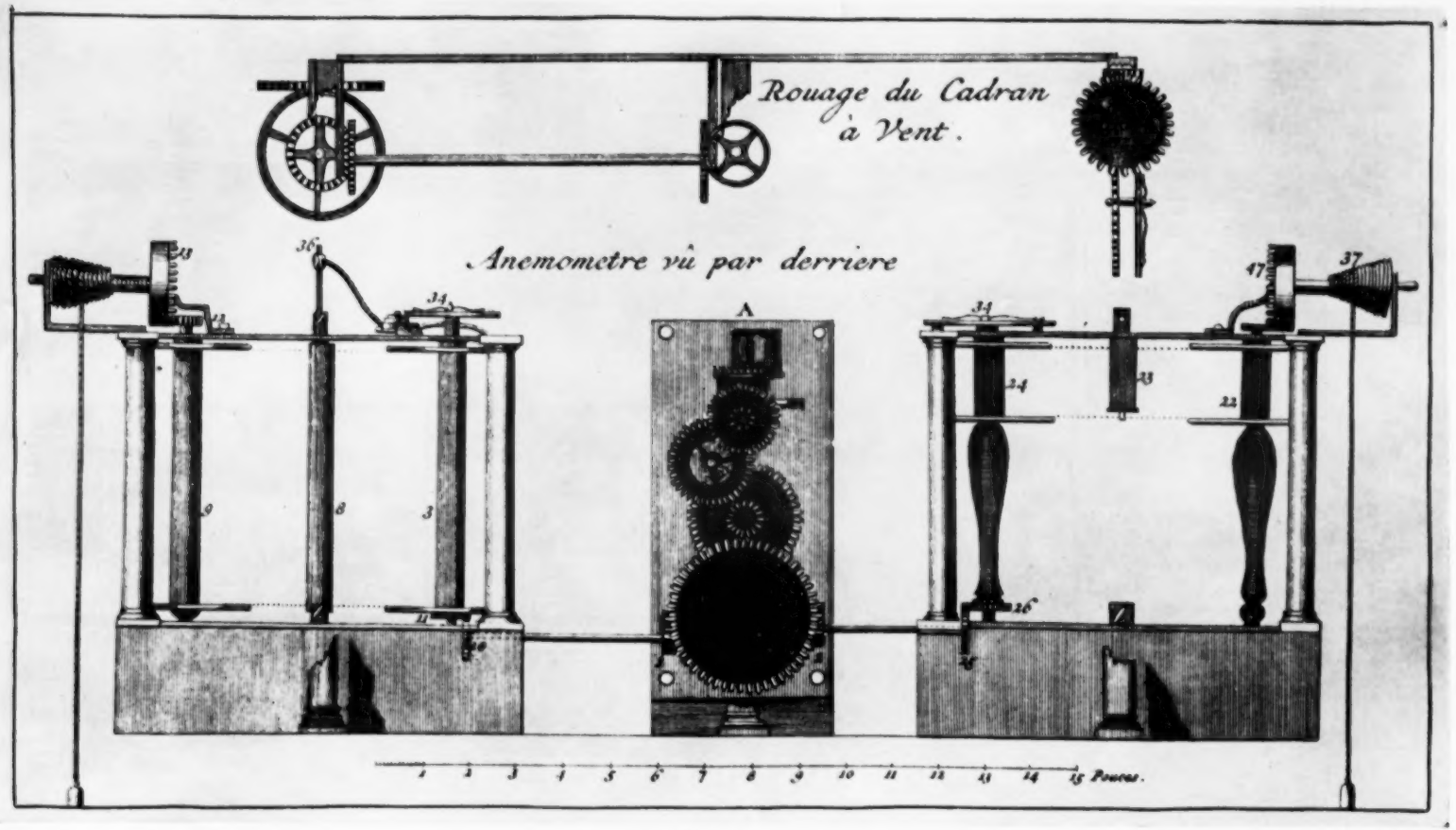
FIG. 3.


Rouage du Cadran
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Pouces.

FIG. 4.

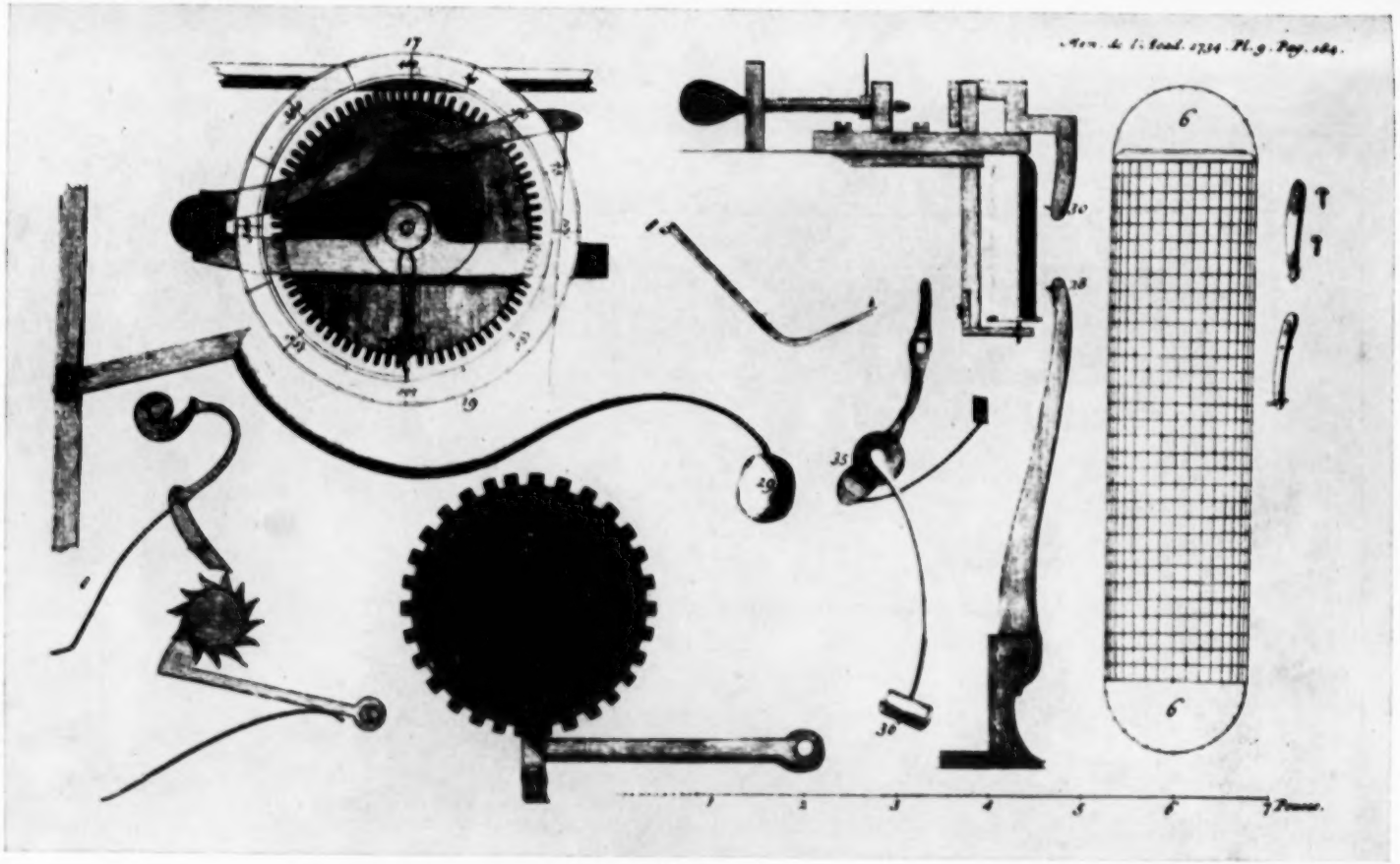
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FIG. 5.

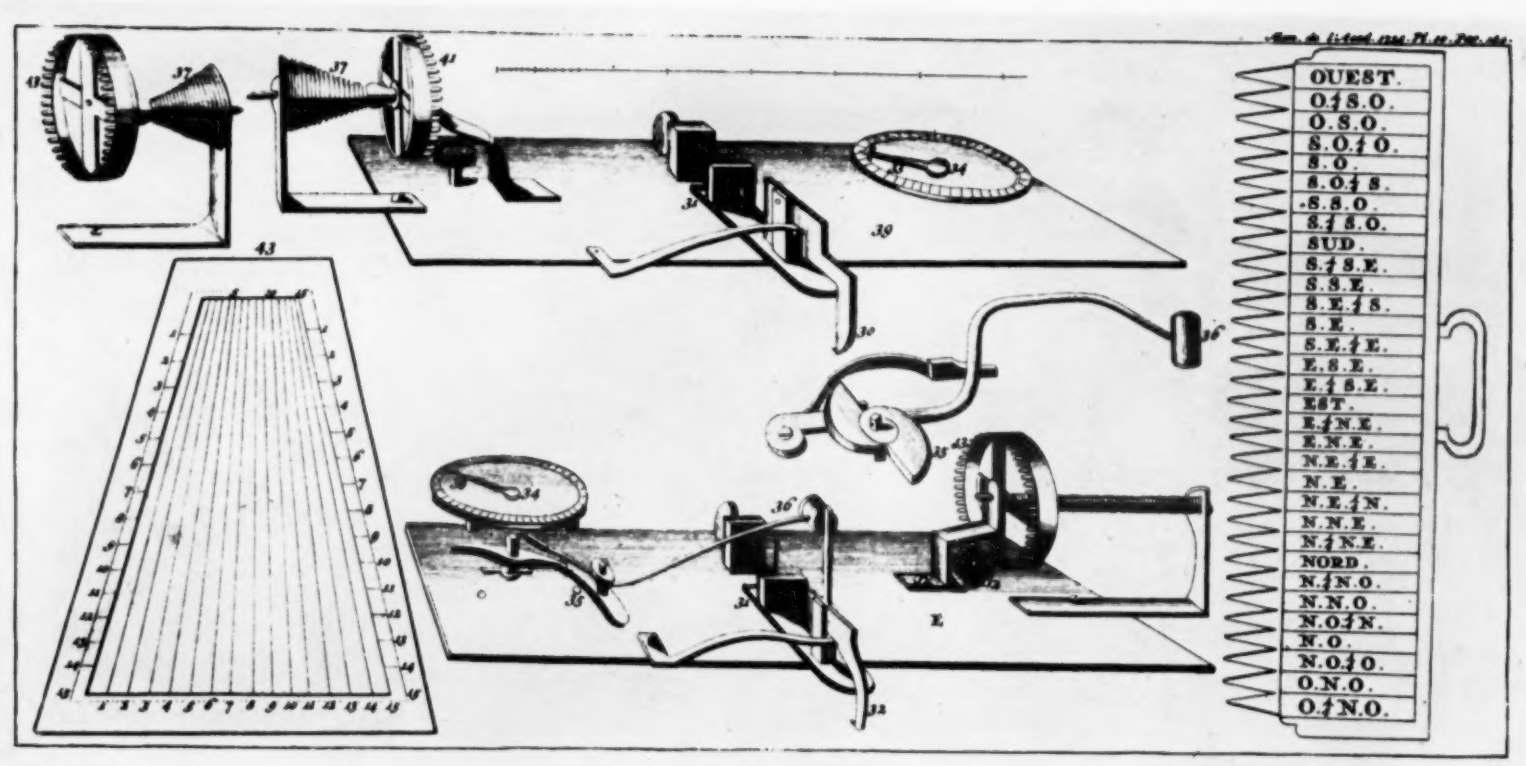
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Fig. 6.

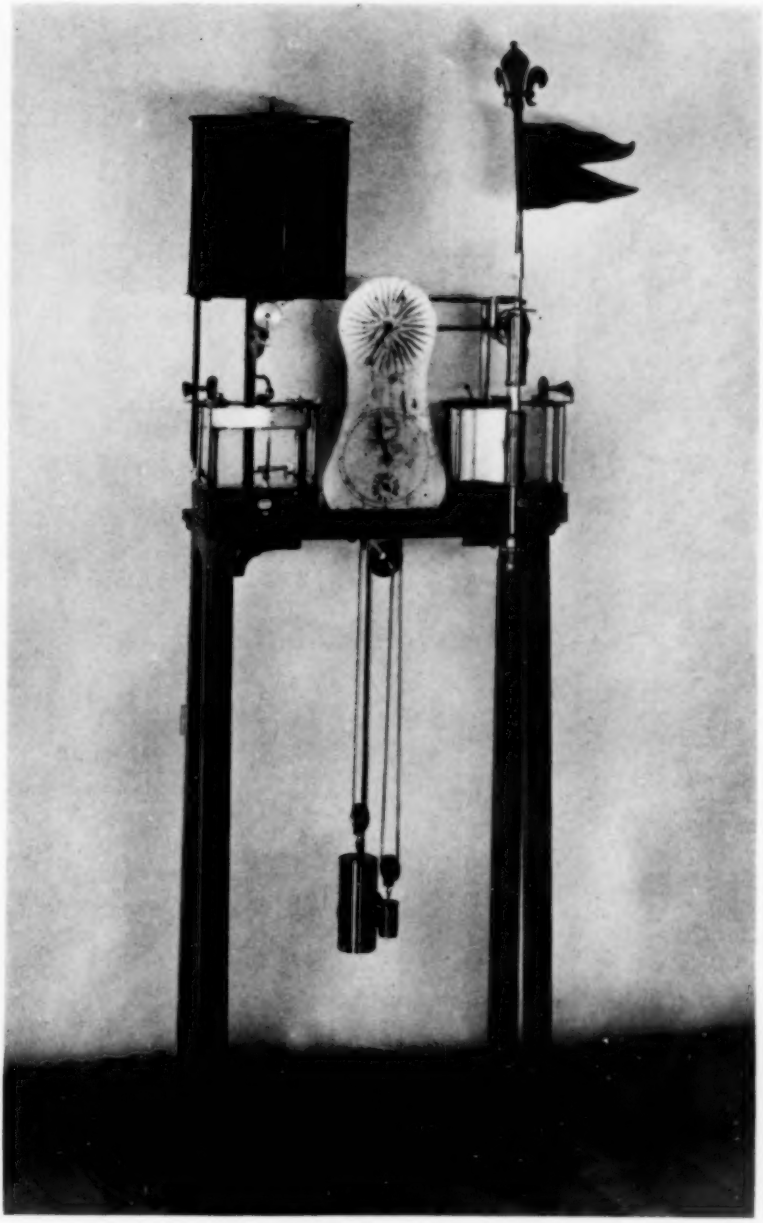

Fig. 7.

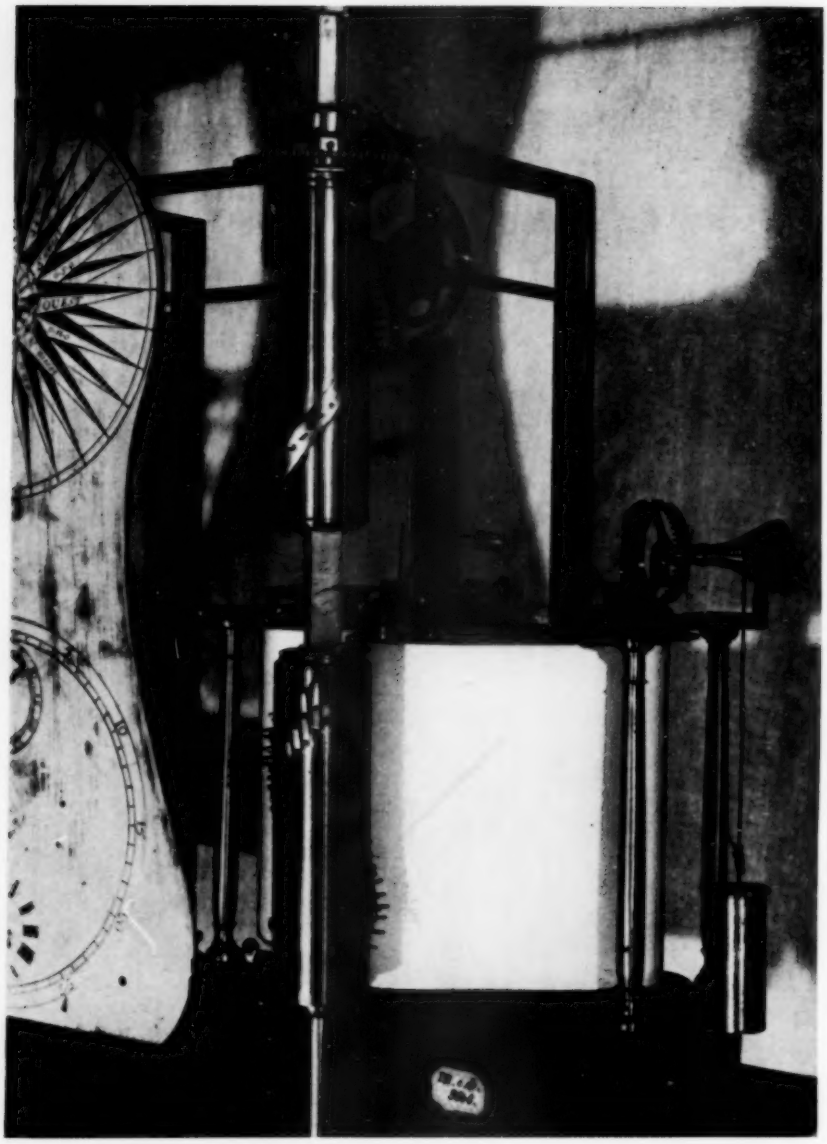

FIG. 8.

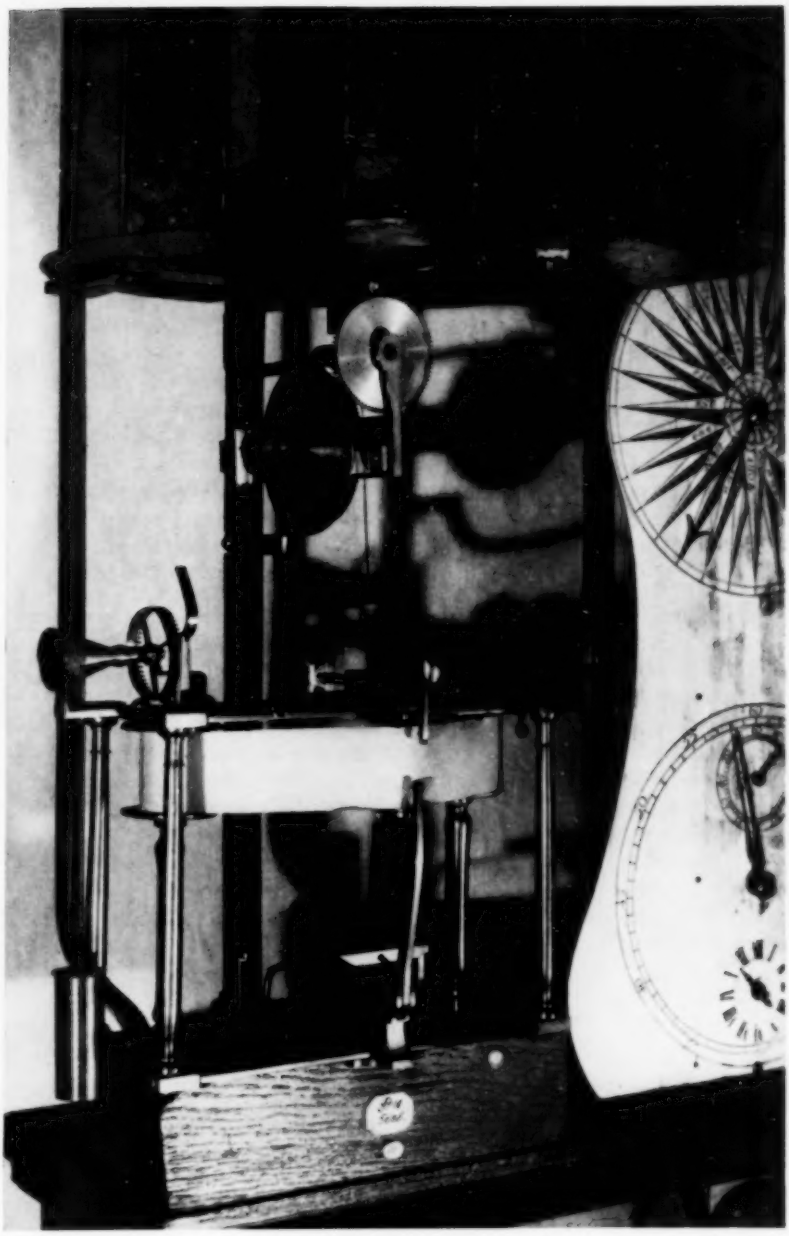

FIG. 9.

shows also the connections of the two recording systems to the common clockwork mechanisms. Above is the gear train to the central wind-dial from the weathervane and at the right the gear train of the windmill to the revolution dial.

Fig. 5 (plate 9). Details of construction. At the right, the lay-out of cylinder 6 to locate the pins that serve as styli. At the extreme right are two springs carrying the styli, one showing separately the two screws, the end one to hold it to the cylinder, the second to regulate tension. Next to the left is a profile of the tension device for cylinder 23 which gives counter-pressure for the two styli marking wind velocity above (30) and time below (28). Below (35), is a view of the cam and hammer assembly for striking time, seen better in Figure 2. On the upper left is wheel 18, driven by the worm gear on the axle of the wheel 16, which in turn is driven by the pinion on the shaft of the windmill. This wheel turns the indicator of the velocity dial, and on it is the spiral cam which raises lever 21 with each revolution and lets it fall to permit hammer 29 to strike punch 30 once for each 400 revolutions of the windmill. Below is wheel 44 (black, and unnumbered) which can be placed on the bases of spools 3 and 24 so that when fully loaded with paper, the pivoted latch can be slid into place to prevent unwinding of the paper until the machine is placed in operation. At the lower left is undoubtedly the escapement of the clock.

Fig. 6 (plate 10). At the right is the ingenious ruler for reading with ease the wind direction from the record; at the left the device for subdividing the intervals of quarter-hours into minutes despite a variation in paper speed, caused by the progressive decrease in diameter as the paper wound up or unrolled. Between them (35) is apparently an alternative construction of the double spiral cam system for striking time on the direction recorder. From its obvious resemblance to a section of snail-shell it is clearly the "snail-wheel" of early English clock-makers, and the "limaçon" referred to by the author. The cam system on the full plate below it is more properly termed a "lynch-pin" and is similar to the cam system 27 (Fig. 1) which is referred to as a "goupille" and which is technically similar to the English "cotter-pin". Here it is a pin penetrating the axle and projecting on both sides, so that the stem (28) of the time-striking mechanism is activated twice at each revolution of spool 24.

Ons-en-Bray's Anemometer as it Exists Today

The statement in de Fouchy's eulogy that Ons-en-Bray's collection had been willed to the Academy and placed at the King's direction in the Academy's quarters in the Louvre suggested at once that some trace of it might be found. A letter of inquiry to one of the permanent secretaries of the Academy brought an immediate response from M. de Broglie that the Academy no longer possessed the instrument, nor, for that matter, did it have any knowledge of its whereabouts. Most graciously he had, however, referred the enquiry to the French National Conservatory of Arts and Crafts (Conservatoire National des Arts et Métiers) where its able assistant director Maurice Daumas, well-known to historians of science as the author of the invaluable volume on scientific instruments in the seventeenth and eighteenth centuries, published in 1953 by the Press of the Universities of France, quickly located Ons-en-Bray's anemometer in the museum and one other of his instruments, a metronome. How it had come into the possession of the Museum, and what had happened to all the other instruments of the

Ons-en-Bray collection, is unknown. That it had some relation to eclipse of the Academy in 1794 seems almost inescapable. It can hardly be a coincidence that the very two instruments specially mentioned by de Fouchy in his Eulogy of Ons-en-Bray are the only two models out of perhaps several hundred that have survived, and it may well be that the very special interest of the Academy in them accounts for their preservation. Perhaps in the last days of the Academy some loyal Academician chose these as the two pieces most worthy of removal, perhaps surreptitiously, to a place of safety. It is not impossible that the rest of Ons-en-Bray's collection is even now gathering dust in some Parisian garret or cellar, having also escaped the turmoil of the 1790's.

Figure 7 is a recent photograph of the anemometer as it stands in the Museum, most kindly furnished by M. Loiseau, the Director of the National Conservatory of Arts and Crafts. One is struck by the remarkable likeness of the drawing made in 1736 to the photograph taken two hundred and twenty years later, even to the expression on the face of the weathervane in Figure 2—a somewhat different one is sketched in Figure 1. The hanging weights which power the clockwork and occasion its French name, *pendule,* can be seen.

Figure 8 depicts the details of the direction-recorder at the right of the clock. It shows one detail not seen in the original, full-face view: the cylinder 8 over which the paper passes to give counter-pressure to the recording styli. Above the original drum carrying the spiral of styli, whose tension-adjusting springs are most clearly portrayed, is a second drum carrying a similar, but not identical spiral of styli. It can have no conceivable function in this position, and it seems to be an example of an alternate, and possibly less laborious method of constructing this unit. The alternate construction of the cam system (no. 35 in Fig. 5) lends some support to this view. Which of these latter systems was employed in this model cannot be determined from the photograph.

The velocity-recorder to the left of the clock is shown in Figure 9. It illustrates, perhaps even better than the original sketches, the gear assembly by which the velocity dial is activated.

It is difficult to be certain that this instrument was ever in operation, that records were ever obtained, and that they were analysed and recorded. The fact that the instrument in its present state so closely resembles its condition as figured in the original report might seem to support the view that in the years that intervened from its description to Ons-en-Bray's death, it was more a part of his collection than a working instrument. But the weathervane is clearly a sort of finial capping the rectangular rod driving the stylus drum and seems to be demountable, and the ingenious Ons-en-Bray may well have prepared extension rods by which the weathervane and windmill could be quickly connected through the roof of his house. The practical hints about preparation of the recording paper and the measurement of records support the conviction that this instrument did indeed see service in recording the velocity and the direction of the winds.

The translation of de Fouchy's Eulogy now follows. However inconsistent de Fouchy's spelling may be, his style is that of the professional biographer.

EULOGY OF MR. D'ONS-ENBRAY

Louis Léon Pajot, Knight, Count d'Ons-en-Bray,[19] was born in Paris on 25 March 1678, the son of Léon Pajot, Count d'Ons-enbray, one of the Directors General of French Posts and Relays, and of Marie Ann Rouillé, aunt of the Mr. Rouillé who is presently Minister and Secretary of State. His grandfather, also named Léon Pajot, and a gentleman serving the King, was kept a prisoner for four years in Spain where he had been sent by the Queen, the mother of Louis XIV, in the service of the King. If the degradations associated with crime dishonor the posterity of the criminal, why should those incurred because of the zeal and fidelity with which one serves his King and his country not be looked upon as titles of honor?

The young d'Ons-enbray studied the humanities at the Jesuit College of Paris; but while engaged in his rhetoric he was stricken with a considerable eye disorder to the end that his eyesight was feared endangered, and he was obliged to return to his father's house in order to have greater opportunity for recovery.

This circumstance might well have totally interrupted the course of his studies; they were on the contrary perhaps more useful to him than the best of health. In place of Academic Philosophy which he would have studied in the colleges, where nothing else was yet taught, Mr. Quem, a capable and enlightened man who had been placed in his company, had the idea of taking advantage of the enforced leisure of his student by having him listen to the reading of the philosophy of Descartes and the commendable works which had already resulted from it: he had him observe carefully its principles and method, and the whole impressed itself all the better on the young man's mind since the almost total inactivity of his eyes took away even the least opportunity to be distracted. Nature had put him indeed in the very same position in which a Sage of Antiquity is said to have voluntarily relegated himself, that he might not be distracted in his meditations. It was in this way that d'Ons-enbray occupied himself with Philosophy for the duration of his affliction, and the least disputable proof that he had well employed the time was the gratitude that he had for the care of his able master whom he never wished to leave. True Philosophy tends more to adorn the heart with all the virtues than to fill the mind with fresh notions.

[19] There are many spellings of Ons-en-Bray. In this translation we have faithfully followed the vagaries of the author or compositor.

M. d'Ons-enbray's vision having been restored completely, he went to visit Holland; no other journey could have been better adapted for developing the ideas and principles which he had just acquired. Holland was at that time the land of MM. Hughens, Ruysch, Boerhaave, and many other great men. What better form could Philosophy have taken to please someone who was already so well disposed toward it? The Collection of M. Ruysch above all made a vivid impression upon him; at that very time he conceived the design of establishing a similar collection, not specifically of anatomical pieces, but bits of Natural History, and particularly of mechanical works, a science to which by nature he was more predisposed than any other, and which became even more interesting to him by virtue of the ingenious applications that he saw constantly made of it in Holland, as much in the practice of the arts and navigation as to defend the country from the floods which continually threaten it.

The young traveller returned from Holland in 1698, more of a Philosopher and more of an Engineer than ever; however sincere this passion was, he nevertheless found certain obstacles to overcome. We have said that his father was one of the Directors General of the Posts; he had destined M. d'Ons-enbray to be his successor in this position and immediately after his return from Holland he began to instruct him in the means of introducing into this important position the order and efficiency which render it so useful to the Public and to the State, and which only an enlightened and stable administration can maintain. M. d'Ons-enbray was too good a citizen to refuse a task to which he was called both by the public welfare and his father's wishes; he made it therefore his principal occupation: but in the very midst of this work he found the means of saving a few moments for his own pleasure; that is to say, for research in Natural History and Mechanics; he began work on the collection, the design of which he had conceived during his visit in Holland, and which he since has made so rich and celebrated.

Until then he had not exercised the position as Director General of Posts except in the name and under the eyes of his father, but having lost him in 1708, he began to carry it out by himself. We shall not discuss at all here the exactitude with which he acquitted himself of it; we could say nothing of which the public is not already completely informed: but what we ought to add is that in spite of the youth of d'Ons-enbray who was then but 28 or 30, Louis XIV, that enlightened monarch who understood men so

well, honored him with his esteem, charged him with certain secret and delicate matters, of which he gave a detailed account independently of the ministers; and that finally this Prince gave him an unmistakable mark of his confidence in having him summoned during his last illness to witness and seal his will before sending it to be deposited with Parliament.

The death of Louis XIV changed nothing in his status, and when the Duke of Orleans, the Regent, created the offices of Superintendent and Assistant Superintendent of Posts, he gave the first to M. de Torcy and one of the assistantships to M. d'Ons-enbray, who held the position until the termination of the office. This was not the first time that he found himself closely associated with M. de Torcy; he had accompanied him to Holland when he had gone there for the negotiations which preceded the Peace of Ryswick; he had won his esteem and admiration there.

We shall not follow further M. d'Ons-enbray in this career unrelated to the Academy, although nothing that concerns the public good is foreign to it, and we shall hasten to consider him from the point of view which concerns us particularly, as Philosopher, Naturalist, and Mechanic.[20]

From the time that he saw himself master of himself and of a considerable fortune, he conceived of completing the projects that he had formed on his first voyage to Holland, the execution of which he had as yet, so to speak, only preluded; but since on one hand the requirements of his office, which he neither wished nor was able to give up, and on the other hand, the visits to which he was continually subjected in Paris, presented an almost invincible obstacle, he chose the alternative of largely freeing himself from all those things which to the general public constitute the pleasures of society. It is true that this was not a great sacrifice for him; gambling, the spectacles, and all these associations which idleness and fear of boredom foment, without either the heart or the mind ever taking the least part in them, represented to the young Philosopher only inopportune distractions and insipid amusements. He resolved therefore to retrench severely, and henceforth to divide his time between his office and the study of Physics and Mechanics.

With this in view, he chose the beautiful home which the Duke of Chaulnes had built at Bercy upon return from his ambassador-

20 We have preferred to retain the term Mechanic as it is in the original, rather than translate it as engineer.

ship in Rome, which his father had bought, and he in turn had inherited. This location, close enough to the Capitol to permit him to spend all the free moments which his duties left him, was yet far enough away from it to keep away those who could only have distracted him in his occupations. He set aside the greater part of the house for the collection which he had planned to build, and for the Laboratories which were necessary for it. He created a herbarium and a magnificent orangery; the rest, laid out with all the art and all the taste possible, formed, thanks to the happy setting of the place, one of the most pleasant retreats that Philosophy has ever inhabited. One could not detect there a trace of the severity in which it is reproached so much for enveloping itself.

It was there that M. d'Ons-enbray came to spend all the moments which he could steal from his duties. He always employed there a Secretary, a Chemist, a Designer, and all the workers whom he might possibly need for the fabrication of the machines which came to his attention or which he himself had invented. He attracted there as much as possible those of the Academicians whom he thought best suited to fulfill his views;[21] for ten years he had the celebrated P. Sebastien, and the late M. Geoffroy conducted his chemical laboratory for nearly four years. One can imagine, with his predisposition and such assistance, how much he was able to enrich his collection of rare and interesting pieces.

The path which M. d'Ons-enbray followed necessarily led him to a knowledge of Physics and Mechanics, and at the same time it brought him also close to the Academy; in 1716 he obtained one of the two honorary chairs which the King had just established there by the new ruling.

The appointment was for him a new motive for devoting himself with greater ardor to his taste for the Sciences, and a new means of devoting himself to it with greater success. He took part in almost all matters which were dealt with in the Assemblies; and those who understand how much the Sciences which seem the most widely divergent lend themselves to mutual assistance are alone able to judge how much of value he derived from his assiduity at the Academy.

A still more direct advantage was the examination of the different machines which were presented to the Academy or submitted to his judgment; he lent himself willingly to this work.

21 In French, *remplir ses vues.* Does this simply mean "carry out his wishes" or does it have a broader, more philosophical connotation, such as "broaden his horizons"?

Often these machines gave birth to new and useful ideas; more often still he would give them to the designers and make them occasionally see advantages in their own work which they had previously had perceived, or defects which he usually gave to them the means of correcting.

It often happens that Mechanics are deceived by models in which one does not adequately preserve for the parts the same proportions which they will have in the full scale. To avoid this illusion, M. d'Ons-enbray used in his research and in his trials squared pieces of wood which had among themselves, in miniature, exactly the same proportion which carpentry wood ordinarily has on the larger scale. He created a "model woodyard," if it is permissible to use this word,[22] as those who are employed in the testing of metal create a model measure; by this he avoided falling into the inconveniences of using wood of proportions different from the standard size. The same thing took place with pieces of iron or copper, and he said that in this way he rarely made mistakes, at least of this kind, in the results that he expected from his machines.

Although the position that he occupied at the Academy obliged him to no duties, nevertheless he presented memoirs from time to time. One owes to him a machine which will beat the time of different musical airs, always in a fixed position and independent of the caprice of musicians; a construction of measures for liquids, which had been requested of him by the Corps de Ville of Paris, and which prevented as much as possible all the abuses in this sphere. But the most unique and most ingenious of what he had contributed was an instrument designed for observing the direction and the force of the wind. The ordinary instruments are purely passive, and like tools in the hands of the observer. The *anemometer,* or *wind measure,* is indeed of a much more singular type; the instrument knows, so to speak, how to observe by itself and write out its observations. A weathervane, via the movement of a rod to which it is attached, makes different points or pencils,[23] fixed at different heights upon the contour of a cylinder, present themselves; these heights thus represent the different directions of the weathervane or the different directions of the wind. A paper rolled upon a vertical drum is forced, by the movement of a similar drum

[22] In French, *bois équarris.* Words like *timbers, boards, lumber,* hardly give an adequate impression of these miniature components.

[23] The French *crayon* does not necessarily imply a *lead-pencil,* and there is some internal evidence in the original report ("the styli are rounded to prevent them from tearing the paper") that this kind of pencil was not employed in the instrument.

moved by a clock, to pass before these pencils and receive the trace of the one which is turned toward it: if it is always the same, this trace should be a horizontal line; but if the movement of the weathervane makes the stylus change, then the paper is found to be marked by different traces whose height indicates the point on the horizon whence the wind blew, and the length, the time during which the wind lasted. By means of a small windmill *à la Polonaise* and a weight whose cord is wrapped around a spindle, the same instrument also writes what the different forces of the wind have been during this time. The immortal statues of Vulcan so magnificently described by Homer perhaps did not know this better.

M. d'Ons-enbray was however not so limited to the study of Mechanics and Natural History that he did not permit himself occasional excursions into other objects. The volume of the Academy which has just appeared[a] contains a memoir of his on magic squares, in which he presents a very simple technique of constructing them. To render the solution of a problem easier, while allowing the conditions with which it is laden to remain, is in some fashion to imitate Nature who always puts magnificence into the plan of her works and simplicity into their execution.

Even in the midst of all these occupations, the principal goal of M. d'Ons-en-bray was the perfection of his Museum;[24] he labored upon it untiringly and by 1717 he had already made it so rich and complete that few foreign lords came to France without visiting it. We can place in this list Czar Peter I, who upon returning to his state sent to d'Ons-en-bray several lathe-works made by his own hand, and the lathe upon which he had worked them. The Emperor presently reigning and Prince Charles of Lorraine came there several times during their stay in Paris; the Emperor above all took infinite pleasure in it and would have gladly made the acquisition of it if it had been at all possible. The late Elector of Bavaria, the King of Poland, the Duke of Lorraine, the Princes of Saxe-Cobourg and of Saxe-Gotha, and in general all the princes of Germany and Poland who came to France, went to see the museum of d'Ons-en-bray and some of them returned several times. The two ambassadors of the Sultan, Mehemet and Said Effendi, both came and left full of admiration, all the more flattering for d'Ons-

[a] This was true on 13 November 1754 when this Eulogy was delivered; the volume of 1750, in which is found the memoir of which we have just spoken, had just appeared. (Ons-en-Bray, 1757).

[24] In French, *cabinet*. We have translated it generally as *collection*, except here where the context seems to imply both the collection and its housing.

en-bray because these lords, and above all Said Pascha, had minds cultivated enough to understand the real value of it.

On these occasions, M. d'Ons-en-bray knew perfectly well how to do the honors of his house, not only by the magnificent dinners[25] which he gave, but also by the elegant and ingenious festivals accompanying them. These festivals took a small amount of time from those occupations which he held so important, but he gave them for the honor of Science and Philosophy and he was well repaid for what it cost him when he believed he could gain them patrons or proselytes.

He spared nothing in order to fill this Museum with curious and interesting pieces, minerals, singularities of Natural History, anatomical preparations, nothing was costly to him that could fulfill this object. A single nugget or piece of gold found fully formed in a mine cost him forty thousand livres. He had profited from a liquor invented by a M. Guyot, to form a collection of plants entirely preserved in this liquor; he had been so pleased with this that when he was dying he exhorted the King to accept the secret and recompense its author for it; the wish was indeed fully realized, his majesty having accorded the author a considerable pension.

However, what soon made the museum of d'Ons-en-bray more unique than the best of its kind was the immense collection of mechanical specimens which he had gathered together. There was no unique machine, new example of clockwork, of hydraulics, etc. of which he did not at least have a model; and a number of machines of his own design were to be found there.

We cannot pass over in silence a unique part of the Museum which is a type of elementary geometry, totally in machines. Instead of reasoning whereby one deduces the equality of certain quantities, or the projection of certain lines, ingeniously envisioned machines present to the eyes, by continuous motions, the proof of these truths; and this invention, in itself very ingenious, is still more admirable by the motive that produced it. The King in his youth had often paid him the honor of coming to Bercy; the late Marshal of Villeroi asked of d'Ons-en-bray if it would not be possible to facilitate the study of Mathematics for this young Prince by means of certain machines which would represent to the eyes what is ordinarily envisioned only in the mind; soon he had devised this manner of demonstration, unknown until then. The most perfect elements of Geometry, presented on all occasions,

25 In French, *répas*, which has a more comprehensive meaning than dinner.

would have only demonstrated his capacity in this field; these afford a substantial proof of his devotion to his King. We shall leave to the hearts of Frenchmen which of the two deserves credit.

He had also received a number of visits from the late Duke of Orleans, the Regent; this Prince, whose vast erudition embraced all the Sciences, could not fail to be pleased in a place where those sciences that are the most useful to mankind are found gathered together; and in order to repay d'Ons-en-bray to some extent for the pleasures he had tasted there, the Prince gave him the famous burning glass fashioned by M. de Tschirnhaus, and known under the name of *miroir ardent du Palais-Royal.*[26] The Prince could hardly have imagined a gift which could be more pleasing to him.

The collection amassed by M. d'Ons-en-bray was extremely useful to him. One could not show him a machine that he would not notice at once what it had in common with those already in existence, and what it had that was more perfect, or less advantageous. A single glance, and a comparison always easy to make, gave him painlessly what another Mechanic would be able to deduce only after a long process of reasoning.

In the same place where he received the visits of the greatest of Princes, he received, and perhaps with greater pleasure, those of the Philosophers, and above all those of his confreres the Academicians. It was in his discussions with them that he relaxed from his labors and that he gathered ideas to undertake new works. He was always ready to carry out what they proposed as soon as he thought it useful; in a word, he was always and at all times disposed to coöperate in the public good and for the glory of the Academy, or to say it with fewer words, he was a true citizen and a zealous Academician. It was in this manner that he passed with equanimity his whole lifetime.

In the month of October 1753, he was attacked with a malady which he regarded at first only as an ordinary erysipelas but which in a short time became a violent eruption; he himself considered his condition dangerous, and after having taken the precautions

26 "The famous burning glass," constructed in Germany by Ehrenfried Walter, Graf von Tschirnhausen. Tschirnhaus made both burning mirrors and burning lenses to concentrate the sun's rays for studies of intense heat. One of the latter was given by the Duke of Orléans to the Academy of Sciences where it was used between 1702 and 1708, and then resurrected in 1772 by Lavoisier as a source of heat for his studies on combustion. The instrument given to Ons-en-Bray is most certainly a burning mirror. Tschirnhaus was named a foreign "Pensionner" of the Academy of Sciences in 1699, and in that year published a memoir on Effets des verres brulans de trois ou quatre pieds de diamètre" in *Histoire de l'Académie Royale des Sciences. Année 1699* (Amsterdam, Mortier, 1734, pp. 120-6).

which his religion, to which he had always been deeply devoted, required of him, he wished to give to the Public, to Science, and to the Academy a last token of his attachment; in the light of this he asked M. Rouillé to request the King to consent to the gift of his Collections to the Academy, with stipulations that would make them useful to the Public and to Science: for in spite of his attachment to this group, the interest of the Public and Science was even dearer to him; and this outlook did not diminish in any way his gratitude to the Academy, which forcibly expressed the same sentiments. The King acknowledged the generosity of d'Ons-en-bray and not only accorded him his consent, but indeed desired that this rich gift be housed in the Louvre,[27] at the very doors of the Academy; and to do everything necessary to support it and to place the public in a position to benefit from it.

As soon as M. d'Ons-enbray received word of this, he made his intentions known to the Academy, and on the first of December, 1753 he made a Codicil by which he willed his collection to the Academy. In the same will he set forth the conditions under which he made the gift, which tended both to insure it for the Academy and to make it useful to the Public.

More at ease after this arrangement he did not cease to occupy himself with the means of augmenting the gift he had just made us; he even gave several commissions on the subject, and if his death has rendered them without effect, it should not in the least diminish our just gratitude.

This was the sole occupation of d'Ons-enbray during the remainder of his illness. Although his illness caused him unbearable pain, this long trial did not disturb for a moment his constancy and his resignation; it did not even alter a deep store of gaiety which was natural to him. He knew how to put his sufferings to some good through the patience with which he endured them, and on the 22d of February of this year, at the age of almost seventy-six years, he ended his career.

The total course of this man's life had been a constant and exact practice of natural equity. During all the time that he was Director of Posts, no commissioner could complain of having been dismissed with capriciousness or without legitimate reason; far

27 The "old" Louvre, around which the present Louvre was still being built at that time, was the meeting place of the Academy of Sciences. It was also the site of its laboratories and observatory, for, like the Royal Society in its early days, experiments and observations were actually performed in its quarters. As early as 1608 Henry IV employed makers of scientific instruments and gave them quarters in the Louvre.

from it; he took care to appoint children of those men who had served well: a commission under him was, for men of integrity, a veritable heritage. In his household, he was a good but severe master, not allowing one to fail him; for the rest, he was extremely careful to provide those in his service with all they might possibly need, as much in sickness as in health. It was not even necessary to be of his household to have an understanding of the sensitivity of his nature; all honest men in need could have access to it. Apart from the considerable sum whose apportionment he had confided to the curates of Saint Germain l'Auxerrois and Sainte Marguerite, his parishes of Paris and of Bercy, he reserved for himself other sums which he distributed himself, and secretly, wishing to avoid that cruel manner of succoring the unfortunate, while hurting feelings, which survives often in hearts highly placed in dignities and fortune. He caused to be distributed to the sick of Bercy, by the artist whom he had employed there, all the medicine they needed, and often even other aid.

M. d'Ons-enbray had had seven brothers and sisters, of whom several had married; and he believed himself permitted to choose an heir among all his nephews. His choice was in favor of M. le Gendre, Lieutenant General of the king's armies, brother of the late President le Gendre, and son of M. le Gendre, successively Intendant of Montauban, Pau, and of Tours. He had given him the living of the d'Ons-enbray lands, and by will made him his universal heir, assigning to other heirs certain considerable legacies.

His position of Honorary Academician has been filled by the Marshal of Lowendal.

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A Jenner Letter*

K. BRYN THOMAS**

ON 6 November 1800 Edward Jenner set out from Cheltenham for London, arriving with his family at Bond Street on the 8th. In contrast to his later mood of disillusionment with London and its people, which occasioned his permanent return to practice in Gloucestershire in 1804, Jenner's feelings at the end of 1800 with regard to the success of vaccination were evidently optimistic and are exemplified by a letter, written from Bond Street on 28 January 1801, to his brother-in-law, William Davies, Rector of Eastington near Stroud, Gloucestershire. This letter, hitherto unpublished, is now in the library of the Reading Pathological Society.

William Davies (1740-1817) had married Jenner's sister, Ann, by whom he had three sons, all of whom are mentioned in the text which follows. The eldest of these, William Davies, D.D., was at this time Rector of Rockhampton, a name which recurs in Jenner's family history, for his father and two brothers had also been rectors of this Gloucestershire village. It is perhaps a clue to Jenner's own affection for his native county that his family was so deeply rooted in the district. It will be recalled that in earlier life he had refused the post of Naturalist to Captain Cook's proposed second expedition in order to begin practice in his native Berkeley.

William Davies, Senior, like other members of Jenner's family, actively assisted him in his work, and a manuscript copy of the *Inquiry* in the Mockler collection[1] is said to be in the hand of Jenner's brother-in-law.[2] This collection also contains prescriptions written for William Davies by Jenner.

The letter shows Jenner in characteristic mood, somewhat facetious, interested in his own and Davies' family concerns, rather pleased with his position, but above all enthusiastic over vaccination, though it will be noted that he terms it "vaccinism." The word vaccination was first used by Richard Dunning, Surgeon, of Plymouth, as mentioned by Jenner in a letter to Dunning dated from Berkeley, 2 April 1804.[3]

* A paper read to the Historical Section, Royal Society of Medicine, London, 7 November 1956.

** Reading, England.

1 Wellcome MS. No. 5040.

2 *Brit. med. J.*, 1896, *1*, 1257.

3 Baron, John, *The life of Edward Jenner*, London, 1827-38, II, p. 336.

Letter of Edward Jenner to Revd. William Davies,
28 Jan. 1801 (Fig. 1)

Dear Brother,

You could scarcely expect that another Bond Street letter would tred so quickly upon the heels of the last.

I am much obliged to you for the recipe for wine. It must be a good one, as it has had so many years to grow perfect under your auspices.

Your feelings and mine were different at the sight of Cheston's signature to the Cowpox Institution at Gloster. He came up to Town some time ago with a budget of papers, vainly supposing they tended to upset my doctrine. A medical meeting was convened, but ere he had gone thro' his evidence, it was voted to be nugatory and absurd and the private opinion

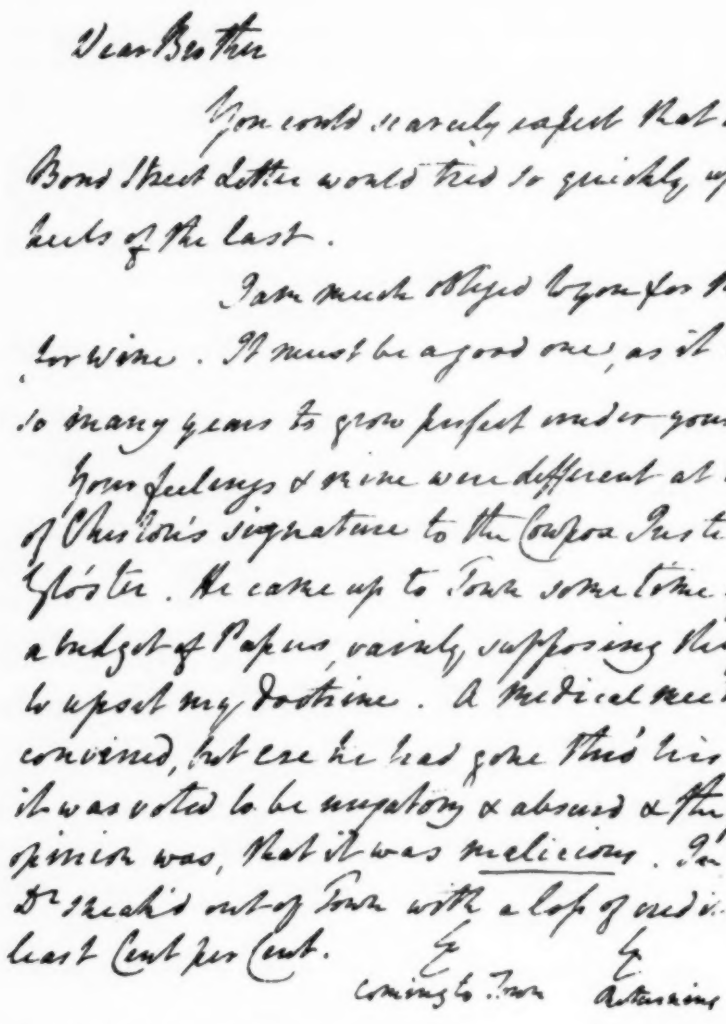

FIG. 1. First page of letter to William Davies, from Edward Jenner, his brother-in-law, 28 January 1801.

was, that it was *malicious*. In short the Dr. sneak'd out of Town with a loss of credit of at least Cent per Cent.[4]

He was driven to a corner, & had no alternative. Vaccinism was never in higher estimation than at present. It is fixt for a certainty that Parliament shall take the matter up in the course of the present session but exactly in what way it shall be brought forward is not now known or decided upon. I have the pleasure of saying that I have many powerful Friends & feel confident that they will exert themselves. I am much pleased with a Communication from Plymouth, which is, that the Navy-Surgeons in that district intend complimenting me with a Gold Medal. This mark of attention is extremely gratifying to my feelings. Should not the Ladies of Gloucestershire, over the beauty of whose offspring I have placed so strong a shield, shew me (their countryman) some similar mark of gratitude? I don't exactly mean a medal.

Pray mention this to my generous friend at Millend.[5] Are you beginning to tire of this subject? Take a pinch of snuff and hear a little more. A great man at St. James's had not fully considered the value of the cowpox till lately. But having heard that it prevents the *Dog Distemper* & having lost by it four fifths of his pack, Lord Sandwich (the Mastr of the Buckhounds) has been with me to request that I will endeavour to save some of the remainder. It is therefore decreed that a receptacle is to be found at St. James's & that I am to have the honor of inoculating his Majesties whelps. However this may lead to an interview, and that may lead to something else. I have not forgotten William's seal, but Mrs. Jenner is fearful she has mislaid, at least, the Drawing. I presume he cd easily replace it from the pencil of the active Henry. Poor Edward is gone to school with all the composure I could wish, & I can with truth say, tho' some peculiarities are still too conspicuous, that his intellects are clearly beginning to burst those fetters which kept them so long benumb'd. I don't at all despair of seeing Clinch one of the Illuminati by & bye. If he is still with you remember me to him and tell him if there is any particular Book or anything else he wants, I shd be happy to get it for him. But at the same time say that I shall do this wth greater pleasure if I find he conducts himself properly; as for teising his Playfellows & such silly trifling, he has doubtless done with all that long ago.

Enclosed is the amount of Mr. Moore's Bill with 5/— over for Clinch. I hope he will write to his father by an early ship—they begin to sail as early as March.

I shall be glad to receive the promised letter from William. Burland, I hear, died immensely rich. I think he was a complete Miser. Yr brother has not yet called upon us. I thought there were sufficient attractions in this House. But altho' the attractions I allude to are not weakend by our residence here, he has not been. I call a certain Lady the *Key* of the *Lock*.— Parson Andrews soon smelt her out. He comes to see us dress'd in full sacerdotal uniform, black apron, &c., &c. He is certainly a Man of Talent, & talks sometimes of ending his days at the place where they began.

I hear nothing of the Castle except that the Peer did not put my name upon the Venison list this year a circumstance quite new. A[m I][6] at length suspected to be a Methodist?

[4] Here follow two caricatures showing Cheston "coming to town," and "returning." (See Fig. 1.)

[5] This sentence is inked over in the original.

[6] The bracketed letters were cut away with the seal, which has been pasted on again in another position.

Do you ever see or hear anything of the eccentric curate of Hornley? I sometimes get a very odd letter from him. I fear he is one of those unfortunates that no effort will benefit. Latterly I have had more reason to suspect that his head was [more] *a la Paul* than ever. When yr Revd son writes, desire him to give me his sentiments & yr own on this point. How go on Robert & the shuttle? Edward & mechanicks?

With best affections to you & yrs,
Yr. faithful Fd E. Jenner.

P.S. The drawing of the arms is found.

When Farmer Tanner comes I should be obliged to Wm. for a copy of the song on Porter.

[Address, with illegible postmark, and Seal][7]

London January Twenty/Eight 1801/ Ailesbury/
Revd Mr. Davies/Eastington/Stroud/Gloucestershire.

The matter of main interest in this letter is the reference to inoculation of cowpox as a preventive of distemper in dogs. This disease had become very prevalent in the latter half of the eighteenth century, and many a pack of hounds had been decimated by it, including that of the Earl of Berkeley. This aroused Jenner's interest in the disease and he records autopsies on nine dogs from Lord Berkeley's kennel, conducted between May 1796 and April 1806. His day-to-day notebook for this period[8] gives details of these, but though he states that the condition of the lungs occasioned the animals' deaths, he does not seem to have arrived at any definite conclusion.

Baron[9] notes that Jenner and his nephew, George Jenner, vaccinated about twenty of his Majesty's staghounds in June 1801, this being the episode about which Jenner sounds so scornful in the letter. Jenner himself, writing to Dr. de Carro of Vienna,[10] communicated his experiments on the inoculation of dogs with cowpox, in which he produced a disease resembling a mild distemper, and stated that these dogs were afterwards insusceptible to vaccinia. This letter was published in July 1801 and is therefore too early to include the King's stag-hounds in the series. Eight years later, on 21 March 1809, Jenner read a paper to the Medical and Chirurgical Society of London[11] in which he describes his investigations upon the fox-hounds of Lord Berkeley. He does not

[7] The word "Ailesbury" is in another hand, and is thought to be a franking signature, the title being so spelled, whereas the place name is spelt Aylesbury. Thomas, 1st Earl of Ailesbury of the new creation, was active at this time.

[8] Drewitt, Dawtrey. *The note-book of Edward Jenner in the possession of the Royal College of Physicians of London*, London, 1931, pp. 45-49.

[9] Baron, *op. cit.*, I, p. 450.

[10] *Med. & Phys. J.*, 1801, *6*, 95.

[11] *Tr. med. chir. Soc.*, 1809, *1*, 263.

record specifically what happened to the King's animals, nor does he elsewhere describe any other experiments in vaccination against distemper and evidently by 1809 he had abandoned the idea. Contemporary veterinary opinion is shown by Youatt's statement, "I have again and again put the power of this boasted preventive to the test . . . and it is altogether without effect"[12] (i.e., against dog distemper).

Jenner's lecture to the Medical and Chirurgical Society demonstrates the breadth of his interests and his knowledge of elementary hygienic measures. He mentions the confusion of dog distemper with hydrophobia, though Youatt[13] says that Jenner's description was "made up of rabies and distemper, and unlike both." Jenner records the infectivity of distemper, particularly among young puppies, but "fortunately," he says, "this distemper is not communicable to man," and he notes the dog's immunity to a second attack.

Certain of the other references in the text of this Davies letter are obscure, as for instance, the Lady who was called the Key of the Lock. Some of the characters mentioned have not been traced, but several names appear which achieved contemporary prominence. Richard Browne Cheston (1738-1815) was surgeon to the Gloucester Infirmary and was elected F.R.S. in 1771. His attempt to discredit Jenner had evidently resulted in conversion, for it seems that he subscribed to the Cowpox Institution at Gloucester after a period of unbelief. Jenner's pleasure over his discomfiture is plainly shown both by his statements and by the caricatures "coming to town" and "returning." It has not been possible to trace the Cowpox Institution of Gloucester. No official vaccination centre appears to have been opened in the town till 1831, but it is possible that the "Cowpox Institute" may have been an unofficial forerunner of this.

The presentation of the Gold Medal by the Navy Surgeons was organized by Dr. Thomas Trotter (1760-1832) who was an admirer of Jenner. Towards the end of 1800, Earl Spencer, then First Lord of the Admiralty, approved its introduction and orders were issued to Navy Surgeons. Dr. Trotter, who at that time was physician to the Channel Fleet, wholeheartedly supported the idea, as he had done since vaccination became known. This was an important event for the progress of vaccination since it showed official approval, with its subsequent influence on public feeling.

12 *Veterinarian*, 1830, 3, 88.
13 *Ibid., loc. cit.*

In a letter dated 9 December 1800, Trotter observes[14] "that the Jennerian inoculation will be deservedly recorded as one of the greatest blessings to the navy of Great Britain that was ever extended to it." Trotter's essay *On drunkenness and its effects on the human body,* his thesis of 1788 for the doctorate of Edinburgh, was republished in 1804 bearing a dedication to Jenner, while a

ALBA NAUTIS STELLA REFULSIT
1801
GEORGIO TERTIO REGE
SPENCER DUCE
Explanation
Of the Naval Medal presented by the Medical Officers to Dr. Jenner 1801.
Apollo the God of Physic presenting a young Sailor just recovered from the Vaccine Inoculation to Britannia who in return extends a Civic Crown on which is written the word Jenner. On the reverse an Anchor with Mottos expressing the reign of George the Third and the Naval Administration of Earl Spencer.

FIG. 2. The Navy Medal, reproduced from the frontispiece to *Medicina Nautica,* Vol. 3, 1803, by Thomas Trotter, M.D.

picture of the gold medal itself was shown as frontispiece to Trotter's book *Medicina Nautica,* vol. 3, London 1803. The medal was forwarded to Jenner on 20 February 1801 and shows Apollo as the god of Physic introducing a young seaman, recovered from the vaccine inoculation, to Britannia, who in return extends a civic crown on which is written JENNER. Above: "Alba nautis stella refulsit." Below: "1801." On the reverse, an anchor and over it: "Georgio Tertio Rege"; underneath: "Spencer Duce."[15] (Fig. 2) Trotter wrote Jenner a long, declamatory letter to accompany the medal, together with the list of subscribers, 87 naval surgeons

14 Baron, *op. cit.,* I, p. 405.
15 *Ibid.,* II, p. 456.

and their respective ships being named.[16] The medal itself has been lost, and little is known of the medallist, Thomas Harper.

After this initial keenness, it seems that the Navy fell from grace, for Francis and Stevenson quote a letter from Jenner to Dr. Richard Dobson, then surgeon to the Royal Marine Infirmary at Chatham, dated 16 February 1814.[17] "You speak of the vaccine—I will just ask if you know how it happens that the Navy is not plac'd under its protecting power as well as the Army? I often hear of it making great havoc among our ships at sea."

An interesting point occurs in relation to Jenner's humorous remark regarding the ladies of Gloucestershire, over the beauty of whose offspring he had placed so strong a shield. Baron mentions[18] that in 1814 "the mothers whose offspring had already been protected by the vaccine shield, the daughters whose beauty had been preserved by its benign influence, intended to unite in offering a tribute of their gratitude to the author of vaccination." The similarity of phrasing and thought is obvious, but whether due to any factor other than coincidence it is impossible to say. It seems unlikely that Baron saw the Davies letter, but it is possible that Jenner, liking the jest, reproduced it on other occasions. In any event, the tribute was never presented.

The name of Moore, mentioned in the text, may refer to James Moore, who is of considerable interest to students of the early days of vaccination. James Carrick Moore (1763-1834) was a younger brother of Sir John Moore, of Corunna fame, and a London surgeon who became a champion of Jenner's vaccination. In 1808, when the proposal to create a National Vaccine Establishment was mooted, Moore was nominated as assistant director, Jenner himself being director. Jenner found that his position was unsatisfactory, for Baron says[19] that the Board under whom he served "soon contrived to let him feel that he was a Director directed," and when his own nominees for positions in the establishment were refused, he felt that his only course was to resign. The subsequent appointment of Moore as director must have been satisfactory to him. Moore had produced two pamphlets on vaccination in 1806,[20] and

16 *Med. & Phys. J.*, 1801, *5*, 432.

17 *J. Hist. Med.*, 1955, *10*, 359.

18 Baron, *op. cit.*, II, p. 210.

19 *Ibid.*, II, p. 120.

20 *A reply to the antivaccinists*, and *Remarks on Mr. Birch's serious reasons for uniformly objecting to the practice of vaccination.*

his *History of Small Pox* appeared in 1815, followed by the *History and Practice of Vaccination* in 1817. The former was dedicated to Jenner.

Twenty-three of Jenner's letters to Moore are reproduced in Baron's *Life,* and in one of them Jenner writes:[21] "Let me thank you for your kind attention to my nephew E. Davies . . . you have quite fascinated him." E. Davies was Edward, son of William Davies and Ann Jenner, whose interest, according to the letter, lay in "mechanicks."

Clinch, the recipient of 5/—, was another Edward, son of the Rev. John Clinch, who had been a school boy with Jenner and a student in the days with Hunter. John Clinch had emigrated about 1786 to Newfoundland where he had introduced vaccination in 1800. Edward, his son, was sent back to England for education, and Jenner and his family made themselves responsible for the boy[22] who later returned to Newfoundland to assist his father.[23]

Yet another Edward was the boy who was taken to school. This was Jenner's elder son (1788-1810). Jenner's notes[24] record that on 20 January 1801 he went with his son Edward to place him at school at Mr. Evans's in Islington. The boy was frail and received all his later education at home. His death in 1810 was due to pulmonary disease, and the distress of his father is evident in the letters of that time.

Farmer Tanner appears frequently on the Jennerian scene and is readily conjured up as a bluff, outspoken, eighteenth century agricultural worthy. He is mentioned by Smith[25] as a student of the Veterinary College, then in its infancy, and he stumps his way across a good many pages of Baron's *Life* and Crookshank's *History*[26] as a staunch vaccinationist. His veterinary knowledge was of value; for instance, in 1799 when it had become difficult to obtain cowpox vaccine in London, Tanner examined the cows of Mr. Harrison in Gray's Inn Lane and declared that they had the genuine disease. He also experimented with the transfer of the disease between cows.[27] George Jenner, writing to Jenner, is quoted thus: Dr. P (earson) gave a public lecture on the cowpox on Satur-

21 Baron, *op. cit.,* II, p. 384.
22 *Ibid.,* I, p. 89.
23 *Ibid.,* II, p. 350.
24 *Ibid.,* I, p. 435.
25 Smith, F., *Early history of veterinary literature,* 1930, III, p. 235.
26 Crookshank, E., *History and pathology of vaccination,* 2 vols. London, 1889, passim.
27 *Ibid.,* I, p. 157.

FIG. 3. Portrait, reputed to be that of Jenner, formerly belonging to Samuel Merriman, M.D., and now in the Library of the Reading Pathological Society.

FIG. 4.
Samuel Merriman, M. D., Aberdeen
1771-1852

day last. Farmer Tanner was there. . . . The farmer says Dr. Pearson was wrong in some part of his lecture, which he took the liberty to tell him."[28] The postscript to the Davies letter completes the mental picture of Farmer Tanner and is surely an echo of the days when Jenner enlivened the Medico-Convivial Society at Rodborough, and the Convivio-Medical Society at Alveston.

This letter came to the Library of the Reading Pathological Society from Dr. Ernest Ward who died in 1949 at the age of 78, for over 50 years a revered practitioner in Wokingham, Berkshire, where he worked after qualifying at Bristol and becoming house surgeon to the Royal Berkshire Hospital. With the letter is a water-color painting bearing the inscription, "Dr. Jenner when a young man, copied by Mr. Thompson." On the back is written in another hand, "Dr. Merriman of Brook St. had this copied from a picture. Merriman was a contemporary of Jenner." (Fig. 3)

Samuel Merriman, M.D., Aberdeen (1771-1852) (Fig. 4)[29] was great-grandfather of Dr. Edward Ward of Wokingham. He studied under Baillie and Cruikshank at Great Windmill Street, began practice as an apothecary and later became a well-known accoucheur. In 1809 he was appointed physician and man-midwife to the Middlesex Hospital, with the welfare and administration of which he appears to have been greatly concerned. His publications were frequent and diverse in nature and include *Observations on some late attempts to depreciate the value and efficacy of vaccine inoculation,*" London, 1805. He is believed to have been a friend of Jenner and his family. That Merriman was known to Jenner is shown by a letter in the possession of St. George's Hospital, London. Jenner mentions "an excellent analysis of the Report of the College of Surgeons . . . with signature S.M. which I guess to be Samuel Merriman." This letter was addressed from Cheltenham, 6 November 1807, to Charles Murray, Bedford Street, London. Merriman was noted as an antiquary, and is stated[30] to have made a considerable collection of portraits of medical men of which, no doubt, this is one. It has not been possible to trace the original from which the copy was made. The features are finer than those in the known Jenner portraits and the labelling as a "young man" may be misleading, for the hair is shown as greying (compare with the Hobday portrait of 1821 in the Royal Society of Medicine,

28 *Ibid.*, I, p. 160.
29 Reproduced from *Lancet* 1850, 2, 610.
30 *D.N.B.* Merriman, Samuel.

where the hair is dark), and the dress is that of the early 1800's. The picture is reproduced in the hope that others may be able to throw some light upon its identification.

ACKNOWLEDGMENTS

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Figure 2 is reproduced from the copy in the Library, Royal College of Surgeons of England, by permission of the Librarian, and Figure 3 by permission of the Editor of the *Lancet*.

Ancient Roman Folk Medicine

W. H. S. JONES*

DR. Rivers[1] defined magic as a group of processes in which man uses rites the efficacy of which depends on his own power or on the powers supposed to be inherent in certain objects and processes used in these rites, while in religion the efficacy of the processes depends on the will of some higher power whose intervention is sought. Many anthropologists[2] tell us that from magic, in this or some similar sense, medicine arose all over the world. In so speculative a matter dogmatism is out of place, but it seems reasonable to suppose that there was a pre-magic period, when primitive man sought remedies instinctively and unconsciously, as a dog eats grass when sick. As human reason evolved, these remedies survived to the age of magic when, with real powers, mechanical or physiological, were blended powers of the imagination; certain results were supposed to ensue, not from any cause that would today be deemed adequate, but because they were, with due ritual, wished or willed. We must remember, however, if we use the words "magic" and "religion" in referring to ancient times, that our concepts have changed. We no longer think as the ancients thought; when we say that magical rites were used in preparing or giving a drug, we mean, or should mean, that to us they appear magical, but that to the performer and to the patients they were simply "medicine," a part of the cure.

At this period the psychological element assumed a major rôle. Faith healing and suggestion, directed by the medicine man, became the leading factors in therapeutics. Of this stage there are, or were, survivals in many parts of the earth. In course of time the medicine man in many societies gave place to the more or less rational physician, and the use of remedies came to be influenced by a rough but conscious empiricism. This partly replaced the mystical reasons, such as the doctrine of signatures, which flourished in the age of magic, just as these had superseded the instinctive choice of herbal remedies that prevailed in the earliest period of human evolution. These clumsy efforts at inductive reasoning,

* Cambridge, England.

1 Rivers, W.H.R. *Medicine, magic, and religion*, London and New York, 1924, p. 4.

2 E.g., Sir George Frazer, Dan McKenzie, Jeanne M. Fisher. Sigerist, however (*A history of medicine*, New York, 1951, vol. I, p. 114), lays some stress on instinctive doctoring.

distorted as they were by prejudice and superstition, may not have been at first as fruitful as the instinctive quest for cures of primeval man—which, by the way, may be one reason why similar remedies are to be found in folk-medicine in many parts of the world—but they do imply a distinct advance in method.

In Italy, at the time when the earliest extant Latin literature was written, the position of medicine was curious. The medicine man had disappeared (if he ever was there), but a professional class had not arisen to take his place, although Greek physicians (the first in 219 B.C.) were migrating to Rome in the hope of establishing themselves and were meeting with a very mixed reception. For the Romans distrusted Greeks, Greek physicians in particular, preferring to physic themselves and their families, but never produced a scientific medicine of their own.[3] Professional medicine remained Greek in *personnel* and in doctrine; Galen, who practised in Rome, even wrote in Greek. Although Celsus composed in excellent Latin the best short textbook bequeathed to us by antiquity, the theory and practice discussed in it are all Greek.

Medicine, then, remained popular in Italy, yet the writings in which it has been preserved are far from primitive. All are works of educated men living in a highly civilized society. They contain, however, among a great deal that is rational, much that today would be considered superstition, survivals from an earlier age, for primitive beliefs, especially when superstitious, die slowly, leaving many traces behind. In this early Italian folk medicine there was development, but it remained amateurish and popular. The Roman, eager to doctor himself, lent a ready ear to any who came along with a new remedy or a new drug. Many foreigners (mostly Greeks) came to Italy with various nostrums, some of a strange and loathsome kind. This invasion of Italy by poorly qualified practitioners, often quacks or charlatans, was the result of the expansion of Roman power in the second century B.C. It gives to the popular medicine of the country, buried as it is in a mass of later accretions, a special and peculiar interest.

Our sources for Roman folk medicine include more than twelve recipes in Cato's work on agriculture, written early in the second century B.C., and eight in the professional treatise of Celsus, who flourished a little after the beginning of our era. In the first century A.D. we have Scribonius Largus with his 271 *compositiones*,

[3] Wolters, X.F.M.G. *Notes on antique folk lore*, Amsterdam, 1935, p. 110.

and Pliny the Elder, our main source, who gathered together, rather uncritically, every item he came across in his wide reading. Later writers— Pliny Junior, Gargilius Martialis, Serenus, and Marcellus Empiricus—are content with abstracts from Pliny, adding some recipes from other quarters.

These accounts of popular medicine give us remedies only; diagnosis, prognosis, regimen, and etiology are left to the works of professional physicians. This is strange, because the folk medicine of uncivilized tribes today is much concerned with these points. Strange, too, is the rarity of religious means of healing in these works, although magical treatment is common enough. We have in Cato, however, prayers to Mars Silvanus for the health of the cattle, which may be made, we are told, even by a slave.[4] Later on in the book Cato gives an offering with prayer to Jupiter Dapalis for the health of the cattle.[5] There are other prayers with offerings: "to keep away, ward off and remove sickness, seen and unseen, . . . and give good health and strength to me, my house, and my household."[6] The poet Horace speaks of the mother of a child with quartan fever; she prays to Jupiter to cure him, saying that should he recover, he shall, on the next fast day, stand naked in the Tiber.[7] The Romans had a goddess of fever and offered public sacrifices and prayers to their gods in seasons of pestilence. There were, therefore, many contacts of religion with medicine, and the silence[8] on the subject noticeable in Pliny and his successors is rather surprising.

Pliny describes nearly a thousand herbs, shrubs, and trees with supposed medicinal properties, as well as over one hundred parts of various animals and birds. Early folk medicine could not have had so many, but the two *strata* I mentioned just now cannot be kept quite separate. Strangely enough, parts of fish are not so common.

Perhaps the commonest form of a folk prescription is one which contains at least one ingredient actually beneficial or at least soothing, with several others that are useless. In all, about a hundred remedies, mostly herbal, used in ancient times are still in the pharmacopoeia or are used by modern herbalists. Many others are

4 Ch. LXXXIII.
5 Ch. CXXXII.
6 Ch. CXLI.
7 *Sat.* II. 3. 288 ff.
8 The nearest approach to prayer lies in the addresses to plants and herbs. But these are not "prayers" in the sense of appeals to a higher power. They are rather commands, attempts to exercise "magical" powers.

obsolete, not because they are useless, but because they have been superseded by better or speedier remedies. To the ancient prescription was often added some magical ritual or incantation to accompany the preparation or taking of the remedy. Most folk medicines show similar features; the Roman variety differs chiefly from others in the complete elimination of the medicine man or other special agent. Apparently anyone could prepare or administer remedies; it would usually be the *paterfamilias.* Milder ailments were treated with little or no magic; serious or terrifying diseases called for much. The psychological factor was very strong. The Romans were a superstitious people, who believed in and loved ritual of all kinds.

The number and variety of the *medicamenta* employed have worried many enquirers, most of whom are convinced that all medicines had their origin in magic. Magic certainly played its part. But the multitude of remedies, herbal and animal, suggests that everything edible (and many things inedible), were regarded as possible remedies, and that the wisest course was thought to be to try them and see. Hence the "blunderbuss" prescriptions, efforts to make sure of the right ingredient. As a matter of fact, many of the herbal *medicamenta* mentioned by Pliny either really have a curative value or else are inert but pleasant and soothing. Magic, I think, was resorted to in order to reinforce the feeble curative effect of most of the ancient drugs. The loathsome character of a few, such as dung and urine, may originally have been due to an effort to drive out a disease demon, or perhaps to the conviction that life-essence was in them in a concentrated form, but some are included in the materia medica of Celsus, and even of the later books of the Hippocratic *Corpus.* It is just possible that the use in medicine was partly due to the obvious value of manure as a fertilizer.

1. The Romans knew that pine woods were of use in pulmonary consumption. They also appreciated the value of a sea voyage for that purpose (Pliny XXIV, p. 28).

2. Their oesypum (fat from sheep's wool) is our lanoline.

3. Ox gall was supposed to be the most efficacious of galls used. It is in the pharmacopoeia today.

4. Avens, advised by herbalists as an astringent for digestive troubles, is prescribed by Pliny (XXVI. 37) for indigestion.

5. The male fern is said by Martindale (*Extra Pharmacopaeia,* 1941) to be the best of all remedies for tapeworm. Pliny (XXVII. 79) says "expels intestinal worms."

6. Horehound, prescribed for cough by herbalists, is recommended by Pliny (XX. 241, 242) for chronic cough.

As we pass from Pliny's account of herbal remedies to animal we become conscious of a change. In part the change is in ourselves, for we have a greater distaste than the Romans for the excrements and entrails of wild animals. In part, however, the change is real and objective. Take the "cures" for headache; the water left from the drink of an ox or ass, the genitals of a male fox bound round the head, the ashes of a stag's horn applied in vinegar or rose-oil. (Pliny XXVII. 166).

The Romans used a rough system of trial and error, but neither they nor the Greeks had any idea of testing remedies that we should call scientific. But surely purges, emetics, and diuretics would force themselves at once upon the attention of early searchers after cures, and rennet from the stomach of animals as a cure for indigestion cannot be primarily due to any kind of magic.

There were some foods that the Romans, as well as the Greeks, made much use of in their medicines: milk, fats, oils, honey, wine, and vinegar. The Graeco-Roman world had no tea or coffee, nor yet sugar, but their ancient equivalents, all at the command of users of folk medicine, had many merits. Wine or vinegar was the almost universal medium for the ingredient or ingredients, and honey was a very common component. The kinds of milk most valued were human, goat's, ass's and cow's. The fats of many animals were used, particularly that of the pig, but those of the goat, the goose, and the ox were almost as popular. All these were used internally as well as externally.

I must add that of the galls used, ox gall was certainly the most often employed; it is still in the pharmacopoeia, used when there is a deficiency of the biliary secretions and as an aid to digestion, but the ancients used it for a multitude of complaints.

The diseases and ailments that troubled the Romans form an interesting subject of enquiry. As far as we can see from our authorities, malaria and bubonic plague were the only infectious fevers known. Chest diseases and those of the eyes were common enough; dust was everywhere and disinfection unheard of. Moreover, everybody seemed worried about snakes, scorpions, and many kinds of poison.

Here are two examples of early Roman folk medicine taken from Cato:

1. Chapter LXX. Prophylactic for cattle. Remedy for oxen: "If you have reason to fear sickness, give the oxen before they get sick the following remedy: 3 grains of salt, 3 laurel leaves, 3 leek leaves, 3 spikes of leek, 3 of garlic, 3 grains of incense, 3 plants of Sabine herb, 3 leaves of rue, 3 stalks of

bryony, 3 white beans, 3 live coals, and 3 pints of wine. You must gather, macerate, and administer all these while standing, and he who administers the remedy must be fasting. Administer to each ox for three days, and divide it in such a way that when you have administered three doses to each you will have used it all. See that the ox and the one who administers are both standing, and use a wooden vessel."

This is a typical "blunderbuss." Bay leaves and rue help rheumatism, bryony is cathartic and savin is in Martindale, but most of the other ingredients are foods rather than medicines. The live coals are symbolical of the feverish heat to be extinguished in the wine. Three is the magical number *par excellence.* The standing posture and the fasting are psychological factors pointing to the time of the medicine man, for in primitive medicine the server shares the treatment with his patient and seeks to impress him with due ceremony and ritual. The wooden vessel suggests that the recipe is an old one, for wooden ware preceded pottery.

2. Chapter CLX. "Any kind of dislocation may be cured by the following charm: Take a green reed four or five feet long and split it down the middle, and let two men hold it to your hips. Begin to chant: 'motas uaeta daries dardares astataries dissunapiter' and continue until they meet. Brandish a knife over them, and when the reeds meet so that one touches the other, grasp with the hand and cut right and left. If the pieces are applied to the dislocation or the fracture, it will heal. And none the less chant every day, and, in the case of a dislocation, in this manner, if you wish: 'huat haut haut istasis tarsis ardannabou dannaustra.'"

This incantation is entirely magical; the half-reeds meeting typify the healing of the injury. The words are nonsense interspersed with Latin words or words in part Latin, e.g., dares, astat, ista, sis. But, in magic, words have "power."

CELSUS

Our material relative to Italian folk medicine may be usefully increased by adding a few remedies given by Celsus which were, he says, not those of physicians but popular.[9]

He mentions the drinking of a gladiator's blood,[10] referred to with disapproval by Pliny,[11] as a remedy for epilepsy.

For angina is given, as prophylactic for one year, the eating of a nestling swallow;[12] as cure, to burn a nestling which has been preserved in salt and to crumble the ash into hydromel, the mixture to be taken as a draught. "This remedy has popular authority and cannot be dangerous."

Fox liver, dried and pounded, the mash being added to a prescription, or the fresh lung, cooked without touching iron, may be given for asthma. "No wild opinion," says Celsus.[13]

9 IV. 7. 5; IV. 13. 3; V. 28. 7B.
10 III. 23. 7.
11 XXVIII. 4.
12 IV. 7. 5; Pliny XXX. 33.
13 IV. 8. 4.

For pleurisy rustics use with success a draught of germander in water, "not having the remedies prescribed by medical practitioners."[14]

For enlarged spleen, water, in which a blacksmith has from time to time dipped his red-hot irons, is prescribed, apparently as a popular remedy.[15]

The Psylli, an African tribe, who sucked the poison from snakebites, are commended.[16] It is said that "certain rustics have found out by experiment that to eat a snake is a cure for scrofula."[17]

As a cure for toothache Celsus describes treatment that is perhaps the most interesting of his popular remedies. "Country people have found out that if wild mint[18] is pulled up with its roots, thrown into a pot and water poured over it, the patient may be treated in the following way. He must sit by the pot and be covered with clothes, and red-hot stones must be thrown into the pot so that the water covers them. The patient, still covered, should inhale the steam with his mouth open. Profuse sweating follows, with phlegm from the mouth. Good health results for a year or longer."[19]

The difference between popular and professional therapeutics may be illustrated by the treatment of epilepsy in ancient times. The disease was a worrying puzzle to the physician and a terror to its victims and their friends. It was widely believed to be caused by "possession," the entry of evil spirits into the body, while the Romans called it *comitialis morbus,* because its public occurrence on the day of an assembly (*comitia*) cancelled this. I will take a Greek work from the Hippocratic *Corpus,* Celsus, Scribonius Largus, Pliny, and Serenus. The first three were professionals, although Scribonius Largus was not unaffected by popular superstitions, while Serenus (third century A.D.) wrote in not ungraceful verse an epitome of popular remedies.

In *Sacred Disease,*[20] an important work in the Hippocratic *Corpus,* the author criticizes[21] the remedies recommended by those who first gave to epilepsy this name. Their treatment is said to con-

14 IV. 13. 3.

15 IV. 16. 2.

16 V. 27. 3C.

17 V. 28. 7.

18 The Latin word is *mentastrum,* usually *Mentha silvestris.*

19 A close paraphrase of VI. 9. 7. Martindale (p. 744) says that a preparation of one mint has been inhaled for coryza and employed in neuralgia.

20 See Owsei Temkin, The doctrine of epilepsy in the Hippocratic writings. *Bull. Hist. Med.,* 1933, *1,* 277-322.

21 Ch. II (Littré, VI, pp. 364-7).

sist of purifications, incantations, and abstinence from baths and from several kinds of food, one of which is pork. The patient must not wear black or use goat skins to wear or to lie on. The only other place in the *Corpus* where treatment is mentioned is in *Epidemics,*[22] where a case is mentioned which was cured by complete starvation.

Celsus[23] discusses the symptoms of epilepsy in a fairly long chapter. He recommends an enema, or a purge of black hellebore, or both. The food given should be light, pork being one of the forbidden meats, and all kinds of stress and fatigue are to be avoided, as well as chill and heat, including the bath. In certain cases white hellebore is recommended, and also massage, rubbing with old oil and nitre, shaving the head, and salt-water douches. Venesection is the physician's last resource. Sometimes "to mitigate it . . . all you can do is to use exercise, plenty of rubbing, and the food which has been mentioned above, particularly avoiding what we have declared to be harmful."[24] Celsus mentions with disapproval the drinking of a gladiator's blood. One should note that in advising abstinence from pork and the bath Celsus is in agreement with the quacks attacked in *Sacred Disease.* These seem to have played for safety, interspersing their magical remedies with some wise precautions.

Scribonius Largus, himself apparently a doctor by profession, wrote out *compositiones* at the request of C. Julius Callistus, a freedman of the Emperor Claudius. Of those dealing with epilepsy Scribonius says: "This and other remedies of the same kind do not belong to professional therapy, but have seemed to some to have been useful."[25] They include the testicle of a crocodile taken in three cyathi of water for thirty days,[26] and a piece of a gladiator's liver taken nine times.[27] In one paragraph[28] he gives a prescription used with success at Rome by an honourable matron: a hemina of ivory dust, Attic honey, blood of tortoise and of a wood-pigeon (male for boys, female for girls), the mixture to be taken for thirty

22 VII. 46 (Littré, V. pp. 414-15).
23 *De medicina,* tr. W. G. Spencer (Loeb Classical Library), III. 23.
24 End of ch. 23.
25 Compositio XVII on p. 11 of G. Helmreich's ed. (Bibliotheca scriptorum Graecorum et Romanorum Teubneriana).
26 Compositio XIIII (p. 10).
27 Compositio XVII.
28 Compositio XVI: scio Romae honestam matronam aliquot comitiali morbo liberasse hoc medicamento. He adds one rational remedy: white thyme, vinegar, honey, taken fasting for forty-five days. A sharp walk of at least two miles is to be taken after each dose.

days (beginning) when the moon is on the wane, the dose to be spoonsful arranged in the daily order of 3, 5, 7, 9, 11, 9, 7, 5, 3 and so on.

Pliny mentions epilepsy about sixty times, eleven of which occur in Book XXVIII, which is devoted to remedies from animals. In paragraph 4 of this book he mentions, with disgust, the drinking of gladiator's blood. The use of black hellebore is referred to in another place,[29] and also of the seed of black poplar, taken in vinegar.[30] A list of remedies is given in XXVI,[31] which includes panaces, plantago, vettonica, agaricum, quinquefolium, archezostis, baccar, coriander, centunculus, verbenaca, berries of hyssopus, and peucedanum. The last prescription is typical: powdered vettonica, 3 denarii; squill vinegar, 1 cyathus; Attic honey, 1 oz.; scamonium, 2 oboli; castoreum, 4 drachmae. A yet fuller list is given in Book XXX,[32] in which Mayhoff notes five parallels to Serenus,[33] although there are none in the list given in Book XXVI.

Pliny's list of cures in Book XXX gives such medicines as ram's testicles, sheep's blood or gall, ashes of spotted lizard from overseas, various organs of the weasel, ashes of weasel, swallow's blood, liver of kite or lion, testicles of a cock taken in milk and water, twenty-one red flies taken in drink.

Serenus in chapter LVI has the following recipes or "simples": gall of vulture, blood of swallow with frankincense, boiled celery, gall of sheep with honey, horehound with equal weight of honey—three spoonfuls at a time, ash of weasel with that of swallow, rain water from a human skull,[34] stone from the nest of a swallow tied on as an amulet, dill. The parallels to Pliny's second list have already been given.

These five writers, representing but a part of the evidence, Greek and Latin, afford an example—and there are many others—illustrating the relation of scientific medicine to popular. The great Hippocratic authors rely on regimen and light diet for the treatment of all diseases, their chief medicines being purgatives. Celsus, too, in his treatment of epilepsy stresses regimen, but includes purges and enemas. Pliny, however, overwhelms the reader

29 XXV. 52.
30 XXIV. 47.
31 113, 114.
32 See 87-92. Another list is in XXVIII. 224-6, where the testicles of a bear, swine and ass are prescribed, as well as goat's flesh grilled on a funeral pyre.
33 Given in this order: Serenus 11. 1015, 1018, 1014, 1021, 1012.
34 Also Pliny XXVIII. 7. The skull was supposed to retain the qualities of the brain that once inhabited it.

with nostrum after nostrum, many, perhaps most, being of a nauseous and disgusting nature. Serenus, writing as he tells us for poor people, gives only a few of the simplest remedies that were used in his day.

Scientific physicians, realizing that the medicines at their command were of little or no value, used them sparingly. The people, however, frightened by the terrifying features of epilepsy, demanded remedies just as do many sick folk now, who with more reason in these days of anodynes are dissatisfied when they are ill if they do not receive a bottle of medicine. There is no record of the most popular remedy or remedies for epilepsy in Roman folk medicine, for all, lay and professional alike, were at a loss, and the sick and their friends were ready to try anything.

The remedies given by Scribonius Largus are at first sight difficult to account for; a physician, one would think, would know better. He was not, however, a medical man of the highest rank and did not disdain such remedies as hyena's gall,[35] brain of an owl,[36] an amulet for hydrophobia[37] (a particle of hyena skin),[38] and the fat and blood of a black dog.[39] Some of these he learnt from his teacher Trypho, who must have been a *medicus* of the type Pliny disliked. Moreover, his task was to write compound prescriptions, and when rational remedies failed, he was forced back on the irrational.

Equally interesting and instructive is a comparison between professional and amateur treatment of malaria. Celsus for tertian fever relies on regimen. He says:[40]

> It is safer, however, so that we may use the exact order laid down, to try the three remedies, vomiting, clystering, and wine-drinking, on three several days, that is, on the third, fifth and seventh days, with this proviso that on the seventh day wine is not to be drunk until after the time for the paroxysm. But if a tertian fever is not dispersed within the first days, but is becoming chronic on the day when the paroxysm is expected, the patient should keep his bed; after the paroxysm he should be rubbed, then, having taken food, drink water; on the day following, which is free from fever, the patient should keep quiet, avoid exercise and anointing, and be content with water only.

Serenus has the following chapter.[41]

35 Compositio XXXVIII.
36 Compositio XLIII.
37 Compositio CLXXI.
38 Compositio CLXXII.
39 Comopsitio CLXXV (a Tryphone praeceptore nostro).
40 III. 14. 2 (Spencer's trans.).
41 Ch. XLIX (11. 914-22).

There is also another fever, which returns on alternate days, arranging the attacks with the exactness of an accurate balance. That you may be able to check its wild fury you must enclose in wax the seeds of cummin without their tails, place them in a bag of red leather, and tie them round the neck of the patient. A sprig of pennyroyal wrapped up in wool will afford healing odours at the suspected hour. In addition, a crushed flea should be swallowed in egg; horrible to touch, it is easy to swallow in this way.

Plinius Junior[42] among other things says: Write on clean paper the following, to be worn by the patient on his right arm: "Go away from this Gaius Seius,[43] tertian, Solomon[44] is after you." Also let him tie from a thread bread and salt in a linen cloth, tie them by the thread round a tree, and conjure the fever three times by the bread and salt: "Tomorrow guests are coming to me, give them a welcome." Let him say this three times.[45]

Ancient medicine found in malaria a grave problem. "Clinical medicine is almost powerless," says Pliny, "in dealing with quartans."[46] The professional physician was forced to relieve symptoms by careful regimen; popular medicine could do nothing. Shock treatment might sometimes help, as the excitement of battle cured a quartan,[47] but the common people finding no relief in drugs, fell back on amulets and superstitious remedies. (Pliny[48] mentions with disgust the use of fleas, but for quartans, not tertians.) Serenus[49] has an instructive remark about quotidian fever: "that the fever can be driven away by various formulae is an idle superstition of nervous mothers." Children are the most numerous sufferers from malaria. Among the folk remedies for malaria are some very cruel ones. The eyes of a river crab are to be torn out before daybreak and worn as an amulet, but the crab is to be put back into the water.[50] This is for tertians; for quartans the snout of a live mouse with the ear-tips is to be worn as an amulet in red rag, while the mouse is to be set free alive.[51] Pliny speaks of boiling animals alive for remedies.

Scribonius Largus tells us that he paid a large sum of money for a remedy for hydrophobia given by one Zopyrus, a physician. It

42 Ch. XV, p. 89 ed. V. Rose (Bibliotheca scriptorum Graecorum et Romanorum Teubneriana).

43 A typical name, like 'Tommy Atkins'. Actually the patient's name would be written.

44 The incantation is probably of Hebrew origin.

45 Three is a magical number. Apparently the fever is asked to join the bread and salt in entertaining the guests, i.e. to be transferred to them.

46 XXX. 98: in quartanis medicina clinice propemodum nihil pollet.

47 Pliny VII. 166.

48 XXIX. 61-3.

49 Ch. L. 11. 8, 9.

50 Pliny XXXII. 115. Pliny Junior XVI. pp. 89, 90 (Rose).

51 Pliny XXX. 99: Pliny Junior XV. pp. 88, 89 (Rose).

turned out to be an amulet worn on the left arm—a piece of hyena skin wrapped in a rag. Scribonius says that he took pains to prepare such a remedy, but that hitherto he had not had an opportunity to use it.[52] He also gives a prescription for an eye salve containing a hyena's gall.[53] The physician's Greek name, by the way, points to the foreign source of such recipes.

The Romans were rather puzzled, and perhaps frightened, by the strange, nocturnal habits of the hyena and by his weird cry. His habitat is North Africa, but he would be brought to Rome along with other wild animals for the shows that were so popular there.

Pliny gives 8 remedies from the elephant, 10 from the lion, 10 from the camel, 19 from the crocodile, 15 from the chamaeleon, 7 from the hippopotamus, 5 from the lynx, and 79[54] from the hyena. Among the last are some for the bite of a mad dog (flesh, especially liver, taken as food), while the gall cures ophthalmia. Toothache is said to be cured by the touch of a hyena's tooth, loin pains by eating the flesh of the loins, spleen trouble by eating the spleen, with other instances of *similia similibus.* The cures are said to be more effective if the hyena is caught while the moon is passing through the sign of Gemini, and Pliny seems to refer all the recipes to the Magi, whom he feared and hated. Let me add one other instance of "homœopathy": the dung found in the intestines is dried and administered in drink for dysentery.

The wild animals listed above are nearly all African, and one is tempted to indulge in speculation. The only conclusion that can legitimately be drawn is that the remedies belong to the later stratum of imported *medicamenta,* and not to the original folk medicine. Scribonius himself gives a recipe for colitis[55] that he obtained at a price from an African woman. One of the ingredients is "a real African snail, that is, an imported one." What I myself feel (it is entirely a personal impression, grounded on flimsy evidence) is that by "Magi" Pliny often, although certainly not always, meant an African species of magician, perhaps the προγῆται so often mentioned in the spurious parts of Dioscorides.

Weird medicines like these became more numerous as time went on. There are hundreds in Marcellus Empiricus of Bordeaux,

52 Compositiones CLXXI and CLXXII.
53 Compositio XXXVIII.
54 A very long chapter in Bk. XXVIII (27. 92-106).
55 *Compositio* CXXII. p. 53 (Helmrich ed.).

who flourished about A.D. 400, and in the Middle Ages they almost ousted the more rational methods of cure.

Italian folk medicine also has some peculiar features of its own. Its early form received accretions from other sources, chiefly, as far as we can see, from Greek lands and from Egypt. The medicine man and similar characters play no part in it; the remedies can be given by anybody. The rational element, although crude, is not negligible. Perhaps its most interesting feature is the light it throws on the strange superstitions of even the most intelligent of a hard-headed, practical, and virile people.

APPENDIX

Varieties of magic traceable in Roman folk medicine

A. *In preparation of the remedy*

1. A circle was sometimes drawn around a plant
   (To prevent virtue from escaping)
2. The plant was sometimes not to be touched with iron
   (The dreaded metal)
3. The remedy was sometimes not to touch the earth
   (Virtue lost if it does)
4. The gathering to be done at certain seasons (especially at night), and with the left hand
5. There must be no looking back
6. "Signatures" were a guide
   (Lithospermum [gromwell] has pearl-like growths showing that it cures stone in the bladder)
7. Sometimes the attendant is to fast with the patient.

B. *Concerned with administration*

1. "Homoeopathic"
   (Fresh kid's blood for the spitting of blood)
2. Contagious
   (Amulets often: e.g., eyes of crab torn out and worn, but crab allowed to go free)
3. Transference
   (Saliva of horse cures cough, but the horse dies).

C. *Incantations*

1. While gathering
2. While administering
3. Addresses to the plant.

A very interesting address to a plant is to be found in Pliny XXVII. 131. It is certainly a bit of genuine Italian folk medicine; but two interpretations are possible because the word *pullus* can mean either a "chicken" or a "graft," "sucker." The second gives the normal meaning to *agere radices*, but perhaps the word is used punningly; there is certainly a pun on the

plant's name, which is also the imperative of the verb *resedare,* "to soothe." The charm is metrical.

"Around Ariminum is well known a plant called *reseda* (mignonette). It disperses all gatherings and inflammations. Those who use it in medicine add these words, saying them three times and spitting three times on the ground:

> Soother, soothe diseases!
> Dost know, dost know the chick that
> ravaged here thy roots?
> May he have neither head nor feet."

Alternatively, the last two lines could mean:

> "Dost know, dost know, what sucker here struck root?
> May it have neither top nor bottom."

The second interpretation would be an order to the complaint not to spread.

Scurvy in the Gold Rush

ANTHONY J. LORENZ†

BRET Harte[31] called the California Gold Rush "a kind of crusade without a cross." And although six hundred years apart in time, the Crusades and the California Gold Rush had many things in common. Both catalysed great sudden migrations of peoples. The participants in both interrupted an inherently agricultural economy while they invaded a hostile, alien land. Both were fraught with hardships, and in both scurvy loomed large and terrible. DeJoinville[17] has recorded it for the Crusades, and Praslow[65] and Logan[50] for the California Gold Rush.

To continue comparisons, both Crusades and Gold Rush subsequently started the production of antidotes for scurvy. Returning Crusaders had become entranced with the "Median Apples" they found cultivated in Moslem gardens, despite Nicolaus Specialis[79] calling them "acripomorum fructes, quae vulgo arrangiae vocantur"* in his history of Sicily in 1383. They brought back not only a taste for these tart fruits but their seeds as well and thus revived the citriculture of Sicily and extended it to Italy beyond the mere ornamental plantings of oranges, lemons, and citrons, and thence to Spain and Southern France. And it was the demand of the Mother Lode's scorbutic miners for lemons which prompted the *gringo* pioneers of still Arcadian Southern California to extend their patio orchards of a few trees into commercial acreages. Thus William Wolfskill[55] set out some 1,800 lemon trees in 1850 which by 1856 were bearing, and their fruits were shipped by coastwise steamer in boxes to San Francisco to compete with the Acapulco-grown limes of John Sutter, Jr. and the oranges from Papeete, over which the Tahitian queen, Pomari, exercised a monopoly.

Scurvy has ever been the bane of voyages into strange lands and uncharted seas, for in scurvy time is linked with nutrition to form a physiological hazard to exploration. Travel was slow. There was need for easily transportable yet highly stable antiscorbutic foods, such as onions. Cabbages and fruits were too bulky and their "keeping qualities" too limited for a four- to six-month sojourn without reprovisioning. This has been particularly evident in

† Died 20 March 1957.

* "The sour-tasting apple-like fruits commonly called oranges."

Arctic explorations, where even succoring parties have fallen victim to scurvy.[43]

The alternative was a food technology advanced enough to conserve or stabilize the antiscorbutic properties of transportable foods. But, like the Crusades, the great American westward migrations were undertaken before the technology either of speed of travel or of food conservation and processing had advanced far enough to enable people to cope with the abrupt change from an established, though relatively crude, standard pattern of subsistence. Both were ill prepared for further deprivation of essential nutrients over periods of four and sometimes six months— the incubation period for human scurvy, as Crandon[15] has shown so conclusively in his experiments on himself.

Crandon's timetable for the appearance of the various symptoms of scurvy is of extreme value in the clinical study of Gold Rush records:

After	90	days	Increasing fatigue
"	120	"	Blood ascorbic acid level zero
"	134	"	Skin lesions (hyperkeratotic papules)
"	161	"	Petechial and perifollicular hemorrhages
"	180	"	Edema of gums, thighs, and fall in Hb: Impaired wound healing

In Crandon's self-experiment, however, his elimination diet began from a baseline of vitamin C saturation. It is doubtful whether emigrants of '49 enjoyed so high a level of nutrition at the time they started their voyages westward.

In 1848-9 three main routes led from the East and Midwest to the California gold fields. Two of them, the overland and the all-ocean voyage, each required almost six months of travel. No overland company, historians of the Gold Rush agree, arrived intact in California. The third route was by way of Panama or Nicaragua, breaking and bridging two relatively short sea voyages.

Howe,[39] in his review of the New England, particularly the Massachusetts, companies specially organized to carry on trade and to mine in California, compares the land and sea routes in 1848-9. He regards the sea route as safer since arrival was more certain, it was less exhausting physically and financially, and more loosely organized than the overland route but with the disadvantage that participants arrived apparently healthy but "soft" after their vacation-like voyages averaging five months from port to port. The more arduous and interesting plains trip, despite its higher mor-

tality record from cholera and dysentery, hardened its survivors. They were ready for strenuous work on arrival at the mines.

The overland emigrant trails, like the sea voyages, can roughly be divided into two principal routes. The preferred was the northern route over the 7,000-foot South Pass of the Rockies, about 1,800[61] miles and a six-month journey from the "jumping off" places of St. Joseph or Independence, Missouri. Some 44,535 men, women and children had passed Fort Laramie, Wyoming, by August, 1850, Hieb records.[35,36] Of these 39,506 were men and the remainder fairly equally distributed between women and children.

Nearly as many emigrants of the Gold Rush travelled this route (in regular use since 1841) as all the other routes combined. Fort Laramie was the halting place for the ox-trains, and its sutler's store is mentioned in numerous journals as a revictualing place, supplying particularly the few tinned and preserved fruits available there at the time. Here, too, the women were taught to gather wild currants and chokecherries to furnish a touch of antiscorbutic freshness to the monotonous diets en route.

Raids on the Fort's sutler's store for supplies which were regarded as antiscorbutic probably were indirectly responsible for the "scurvy epidemic" in 1849. In Colonel Schell's[72] words:

> In the winter of 1849 the Scurvy was prevalent among the troops at the Post. About one-fifth of all the men were on crutches. On the recommendation of the Post Surgeon a large quantity of wild onions and water cresses was issued by the Commanding Officer, Indians having been employed to gather them. In the following spring a large number of men still remained disabled, many of them obtained sick furloughs and others were transferred to the General Hospital at Leavenworth. . . .

In 1858, ten years later,[78] scurvy again troubled Fort Laramie, but a different remedy was employed:

> Ass't. Surgeon E. W. Johns, writing from Fort Laramie, December 1858, considered that there was little of interest to report except what related to scorbutic disease. He used the juice of cactus* plants, which, in the absence of any other curative agent, effected a wholesome change in the system, as complete, although not so rapid, as that resulting from the use of potatoes. The juice was prepared by broiling the thick leaves slightly over a fire and then slicing and digesting them in water until a thick greenish-brown mucilaginous mixture was obtained. A tumblerful of this mixture, with two ounces of whiskey, flavored with essence of lemon, was given as a dose. At this post stores of water-cresses were collected and used at the mess tables; and so highly was the importance of this addition to the diet appreciated that the colonel commanding superintended the search for the plant.
>
> * Opuntia, or prickly pear, also used by Vizcaino in 1603, according to Fr. Venegas' "Noticias."[54]

Returning to Colonel Schell's report for the following year:

> . . . In the winter of the same year (1859) the Scurvy was again prevalent at the Post, principally among the men of D & F Companies of the 2nd Dragoons. The causes are supposed to have been the want of cleanliness and the defective cooking in those companies. Ass't. Surg. Crawford used in the treatment of these cases, a tincture made by soaking the ordinary cactus, which is abundant in the vicinity, in whiskey. It made a bitter unpleasant drink but is said the have cured the cases.

The other overland route, like that via the South Pass, was also an offshoot of the old Spanish Trail, reopened in 1823 as the Sante Fe Trail, where two routes to California diverged. The Gila River route[24] carried only an estimated 8,000 emigrants to California from April 1848 to January 1849, less than a fifth of the traffic carried by the northern trail over the South Pass. Consequently, fewer journals from its travelers are available. The variant, and still less used, overland trails were those via Texas and Mexico, some of them partly by sea and partly by land.

No matter what route was taken, for the Eastern businessman or farmer, the Southern miner, and even the Midwestern frontier family, the California gold fields meant spanning of the North American continent, just as the Crusaders had to span the continent of Europe.

Although most emigrants made elaborate preparations before leaving home, especially those traveling in organized, semi-socialistic companies, they were poorly advised and consequently ill equipped for the long overland trek. Preparation, Howe[39] states, was far greater than for the war with Mexico just concluded. Books about the California and the Oregon trails, as well as the Mormon trails, were eagerly sought and read. In addition, all sorts of useless impedimenta were collected for supposed exigencies. How much of it was discarded along the route is graphically told in various accounts. Bidwell,[6] Fremont,[25] Seymour,[74] and Bryant[9] were best sellers, and their first-hand knowledge was adapted by Ware[89] into his *The Emigrant's Guide to California.* Ware had actually little more to offer than a condensation of earlier and longer accounts. Occasionally, he gave a "household hint" for the covered-wagon cook.* Ware was an "armchair emigrant," living in Galena, Missouri, when he wrote his guide book early in 1849, although he

* "A good pickle can be made of the 'prairie pea' which grows on a vine similar to the common pea vine in great plenty here [on the prairie] and is as large as a walnut. They are eaten in times of scarcity."

later actually did start out on a trip across the plains which ended most tragically for him. Delano[18] describes Ware's death as follows:

> But the most lamentable case was that of the abandonment by his companions of Joseph E. Ware, formerly from Galena, but known in St. Louis as a writer, and if I recollect right, the publisher of a map and guide-book to California. He was taken sick east of Fort Laramie, and his company, instead of affording him that protection which they were now more than ever bound to do, by the ties of common humanity, barbarously laid him by the roadside, without water, provisions, covering or medicines, to die! Suffering with thirst, he contrived to crawl off the road about a mile, to a pond, where he lay two days, exposed to a burning sun by day and cold winds by night, when Providence directed Fisher and his mess to the same pond, where they found him. With a humanity which did them honor, they took him to their tent and nursed him two days; but nature, overpowered by exposure as well as disease, gave way, and he sank under his sufferings. He told Fisher who he was and related the story of his company's heartlessness. He was a young man of decided talents. Fisher was confident that if he had had medicines and proper attendance he might have recovered.

"Travel guides" were exceedingly popular, and their writers often accused each other of plagiarism.† Galton[27] sums up all his antiscorbutic advice as follows: "Scurvy has attacked travellers even in Australia, and I myself have felt symptoms of it in Africa, when living wholly on meat. Any vegetable diet cures it: Lime juice, treacle, raw potatoes, and acid fruits are especially efficacious [adding] . . . Dr. Kane insists on the value of entirely raw meat as a certain antiscorbutic; this is generally used by the Esquimaux."

Galton lists "sprouted seeds," which were known early as antiscorbutics. They formed the basis for Cook's "anti-scorbutic wort," which many writers on nutrition misinterpret as brewer's yeast. Galton, however, gives a more novel use for them, as far removed from a nutritional measure as can be imagined, declaring that Admiral Sir E. Belcher used the expansive power of wetted and sprouting peas in a cylinder to activate a piston: "A pint of peas, in a tube, lifted 60 pounds one inch in 24 hours."

The pitiful physical condition in which the overland emigrants arrived at the mines is graphically told by A. C. Ferris[23] in his

† In the fourth edition (1867) Galton takes cognizance of the "copying accusations" made by Captain Randolph B. March, author of *The prairie traveler* (N. Y., Harper & Bros., 1859), and carrying the "authority of the War Department". Galton's book had appeared first in 1854. Galton's "food store" list, however, includes no actual antiscorbutics for a six months' journey. For the severe labor of the explorer-traveler, Galton gives a table of nutriments and caloric requirements in terms of "22.5 ounces of carboniferous and 7.5 ounces of nitrogenous" food per day. In his "medical stores" are mentioned only the usual laxatives and aperients, plus quinine, and an "anti-diarrhoea cordial" with the added instructions of using "nothing but broth, rice water—in very small quantities—until health is restored."

reminiscences, which also include the story of a Dr. Deal,‡ a well-trained physician from Baltimore with a penchant for preaching as an ordained Methodist minister.

Dr. Tompkins, who left Havana, New York, in 1850 to cross the plains, was more careful to avoid diarrhea than scurvy, if we are to judge from his journal,[85] which is also a most interesting document in human relations. His provisions for the journey of 4,072 miles in five months consisted of "100 pounds crackers at 6¢, 35 pounds sugar at 10¢, 10 pounds coffee at 15¢, 1 pound tea at $1, and 65 pounds ham at 10¢, so that his trip to California from New York, including two mules and a riding horse, totalled $317.75.

Within two months, by June 1st, "sickness prevailed to a great extent—the Fatal Diarrhea that attacked all that made use of the indispensible element [water] without changing its properties by distillation." The course he pursued was "to obtain water [from the Little Blue] in the Evening, boil it—evaporate most of the deleterious properties," and "drink it only in coffee and tea." Despite his scorbutogenic provisions, he makes no mention of scurvy, although by July 27th, four months from the time he left home, Dr. Tompkins was taken sick "and came near dying" in the vicinity of the Humboldt Sink.*

Here, as they left the Platte and followed the trail of the Big Sandy and Green Rivers, vegetation gradually became more sparse, water more scarce and alkaline. Others veered northwest to follow the Bear River past Soda Springs and Fort Hall, and others via Fort Bridger and the Hudspeth Cutoff into the Great Salt Desert.

On this route, at the southern tip of Bear Lake, a few miles across the Idaho line in Utah, the town of Pickleville had come into being, so named because it was a supply depot for pickles which were highly regarded as antiscorbutics. This reliance on pickles is also found in the earlier manuals[11] prepared specially for

‡ Dr. Deal arrived at Auburn in May 1849 and immediately announced through a "long dinner horn" that he wanted to be one of them—"an honest miner." On Sunday he used the horn to call the miners together for a service of hymn singing, and early Monday morning saw him start out with pick, pan, and shovel. At eleven o'clock he was back in his black coat and top hat and announced he was leaving for Sutter's Fort, where he established a hospital.

* The almost 600-mile stretch between Fort Laramie and the Humboldt Sink through the Laramie Mountains, the "forechain of the Rockies" as they often were called by emigrant writers in their journals, brought the first real exertions of "mountain-going." Henry Page[61] recapitulated the mileage between landmarks on his 1800-mile trek, as follows: From St. Joseph, Mo., to Ft. Kearny, 276 miles; from Ft. Kearney to Ft. Laramie, 302 miles; from Ft. Laramie to the South Pass, 274 miles; from the South Pass to Fort Hall, 273 miles; from Fort Hall to the head of the Humboldt River, 212 miles, and another 500 miles to San Francisco.

the Mormon migration westward. Their antiscorbutic contribution,[42] 2 milligrams of ascorbic acid per ounce, cannot be considered entirely negligible in diets such as emigrants traveled on. If they helped to prevent scurvy, the price of $8 a half-gallon jar cannot be regarded as exorbitant since the vinegar itself was also used medicinally, administered by the teaspoonful as an antiscorbutic.[63] It, too, probably contained slight amounts of vitamin C extracted from the pickles during processing.

The Geiger and Bryarly journal[28] (Geiger was a physician), warns future travelers across the plains against the possibility of scurvy and calls their attention to "lambquarter greens"* as a source of an antiscorbutic salad. He gives curative credit to the "vinegar," adding, "& strange as it may seem they check the Diahrea [*sic*]." Thus, one does find occasionally that the emigrants used the "weeds of the prairies" for salads and greens.

The classic overland journals of Bruff[8] are meticulous observations of an ex-Army man leading the large wagon train of the "Washington City and California Mining Association." They are replete with references to scurvy, including the inscription on a grave marker Bruff found and copied, which reads as follows:

SACRED TO THE MEMORY
OF W. BROWN
Of the Rough & Ready Co'y
of Platte, Mo.
Died with Skervy
Sep 19th, 1849.
Aged 35 years.

Bruff found this grave on 18 October 1849. A month before, he had noted the grave of another, also a victim of scurvy, but with a somewhat more complex sequence of symptoms: "W. Maxwell, died Aug. 24, 1849, cholera. Teamster in 'Pioneer Line.' Took cholera on the Platte, then scurvy; from Independence."

Elsewhere, Bruff tells of encountering a pedestrian who told him "that a few days since, at 'Little Goose Lake' he buried a friend, who died of scurvy: the lady (widow) with 8 children . . . had a son along, in most deplorable condition—emaciated, feeble and as ragged as a beggar. He could scarcely speak, and had to be led about. She said she did not know what was the matter with him, nor had he any medical attention."

* Probably the indigenous "chenopodium album," rather than the "atriplex patulum" of Europe. Both of them are called "lamb's quarters."

Nor, according to Bruff, were doctors immune. On 6 November 1849, a "Dr. Harvy of Pike Co., Mo., came up, on an exhausted mare, himself nearly exhausted with scurvy." Bruff "took the poor man in," and then a "Dr. Austin also pushed in," to share Bruff's "2 day supply of bread and short venison." Soon the Bruff abode was filled with half-starved emigrants, "a gentleman and his son," then two Germans, one of whom carried the rusty sabre he had borne through Napoleonic wars. Bruff had known the pangs of hunger as well as the pains of scurvy himself, having had to rest every twenty paces when his own provisions had been reduced to a tallow and sperm candle which he ate with salt and pepper, noting merely "it tasted bitter," and then, cutting up a piece of rawhide and some leather strings and soaking them, he "gave them to the poor pup to gnaw on." He also "gave her the candle wick."

Read[67] was evidently impressed with the great amount of scurvy she encountered while editing the Bruff journals:

> If we consider cholera the first great health hazard of the trail and mountain fever geographically the second which the emigrant was likely to encounter, then undoubtedly scurvy was the third and last of a trio of ills that filled many a grave on the California route, although the physical areas of susceptibility to mountain fever and scurvy overlapped. Scurvy of course is not a disease but a diet-deficiency ailment, now known to be due to the lack of vitamin C. Unlike cholera, the white man did not carry it with him, except potentially through the essential chemistry requirements of his own body, nor did any native agency act in its spread as did the ticks in the case of mountain fever.
>
> Scurvy began to appear increasingly on the long march down the Humboldt when several months' basic diet of salt pork and flapjacks began to tell but reached its peak between the Humboldt and the Sacramento in the vicinity of the Sierra Nevada. In its earlier stages it was sometimes mistaken for rheumatism, as severe joint involvements, particularly of the legs, marked the condition, sufferers often being unable to walk. Scurvy is an ailment we seldom see nowadays but let no one think the deaths were few or the disabilities slight in 1849 and 1850. Statistics for comparison are necessarily lacking, but we know that while cholera struck swiftly, scurvy killed its scores on scores and often maimed when it did not kill outright."

As Read points out, Bruff's and Stillman's[81] observations do not include casualties from scurvy on other trails, the Carson and the Truckee for example, nor could they record the graves that had been marked only with a stick of wood on which a pencilled note of the deceased's name had been impailed "all to be swept away by the first rain." So serious had the "scurvy epidemic" become on this final leg of the overland trail, that General Persifor E. Smith appointed a relief commission, headed by Rucker and Peoples,[69] to go to the ranch of Peter Lassen. There, in November

1849, they brought in the last of the year's emigrants as Peoples noted in his report, adding: "a more pitiable sight I had never before beheld. There were cripples from scurvy—children who could not move a limb," and "in advance of the wagons were mounted on mules, who had to be lifted on or off their animals, so entirely disabled had they become from the effect of scurvy."

Dr. Stillman,[81] who had sailed to California in 1849, also tells of meeting overland emigrants arriving on the Lassen trail when he himself was heading north to the Feather River mines. He noted particularly the number who were unable to walk because of scurvy.

Brooks,[7] an artist who traveled across the plains in 1859 belatedly to try his hand at gold mining, records finding berries of various kinds along the route. At the crossing of the Sweetwater River, on July 9th, he "found lots of strawberries, and picked enough gooseberries to make a pie." Twelve days later he found "currants and whortleberries by the bushel."

Bryant,[9] who had crossed the plains in 1846 and whose *What I Saw in California* became the basis for guide books, says: ". . . wild currants have been quite abundant along the trail in several places today," and again, "raspberries, and a small, bitter cherry, have been quite abundant." On 28 July he wrote that "some of the party went into the hills to gather service-berries,"* remarking parenthetically, "I do not know that the orthography is correct. It is in accordance with orthoepy. The service-berry is produced by a shrub, generally from four to six feet in height. It is of a dark color, larger than the whortleberry, and not very unlike it in flavor. The fruit is abundant here."

Not all trains were so fortunate or farseeing, dietetically. Kerns,[46] a member of a train of nine wagons and thirty-five persons, left Rensselaer, Indiana, on 15 March, and by August, five months later, following Crandon's scurvy-timetable pattern, Kerns' journal records scurvy. On 21 August, after traveling 2,054 miles, several of the thirty-five original members of the train were "ill with scurvy." Two days later, Kerns records: "Mon., Aug. 23. Some of our trains are severely afflicted with bloody diarrhea, the mountain fever and the scurvy, which begin to make us think we are *treading the elephant's tail.*"

* "Service" berries, also known as June-berries, belong to the Sorbus family. The berries of the *Sorbus domestica* yield Sorbose, which became the starting material for the first synthesis of ascorbic acid almost a hundred years later.

Shaw,[75] who had at first planned to travel on the Harvard-named ship *Edward Everett* but took the trip overland instead, remarks in his journal, "I have many times congratulated myself because of the fact that I was NOT one of the 300 passengers on the good ship 'Edward Everett,' " many of whom were in the incipient stages of scurvy and "a very debilitated lot" on arrival. Shaw's overland party also encountered "grumbling travelers, scurvy and made good use of wild onions."

The letter of W. B. Royall[68] from Placerville, written on 25 March 1850, would bear out this conjecture: "There has been one death this winter among us . . . we have been comparatively healthy. Many companies have lost a third of their number; the diseases have generally been more fatal with those companies that came round the Horn. The companies that came across the plains have been more hardy and stout, owing to their being inured to the hardships by the fatigues of the trip."

Journal entries often give a clue to the improvised supplementation of diet possible on the plains, but unavailable to the seafaring Argonauts who rounded the Horn, excepting at the "revictualing stations" of Rio and Valparaiso, and occasionally at San Juan Fernandez. In most of the "round the Horn" journals specific mention is made of the stop-overs in South American ports, as in the case of the *Duxbury,* one of the first large "companies"* to sail from New England. The *Duxbury,* with the three DeCosta brothers and other members of the Charlestown, Massachusetts, company sailed from Plymouth on 11 February 1849, taking sixty-six days to reach Rio de Janeiro. William DeCosta,[16] the printer-diarist, records on April 19th that the medical inspectors at the port "pronounced us all sound and healthy," and gave them permission to go ashore "to revel in the luxury of tropical fruits." In DeCosta's witty diary the first rhapsody on "Duff, Plum Duff for dinner this day"† changes to a series of "grumblings" over the food served as the voyage proceeded toward the tip of South America.

* The "Old Harvard Company."

† Sea travelers no doubt anticipated the first serving of the sailors' "Plum Duff" as though it were to be a rare delicacy. Thus DeCosta, on 28 February, seventeen days out, writes: "Duff, plum duff for dinner this day! The cry has gone through the ship and the echo is still ringing in my ears. What a treat it will be—every man's eyes sparkle, one would suppose we had heard the cry of 'land ho'!" By 18 March, the tune changes to this: "By special edict Sunday has become Duff day. We fare very well nowdays—on duff. To eat it is like brick-laying, only we have no foundation, but base, body and capstone is alike —and often having the structure raised, or rather lowered for an hour, it becomes fairly cemented together, and it is almost an impossibility to overthrow it. In fact it more often throws than is overthrown."

On the bark *Belgrade* on which Hutchinson[40] traveled from Cherryfield, Maine, there were three deaths on its trip around the Horn later that year, but no mention is made of scurvy. On the fly-leaf of his journal the diarist had lettered boldly his "Receipt for Cholera, one tablespoon salt, 1 teaspoonful red pepper, mixed in ½ pint boiling water." Within two months the *Belgrade* reached Rio, and within seventy days rounded the Cape in a snowstorm, and by 20 March, landing at San Juan Fernandez, brought "quinces and peaches aboard enough to gratify to the gourmandizing propensity of our earthly man."

Sanger,[71] in his journal of the 178-day trip of the *California* round Cape Horn, complains of being kept on a diet of "salt beef and hard bread while the most perishable provisions we have on board are spoiling in the hold of the ship," adding "our passengers are certainly very peaceable people," and called the steward a true specimen of a Boston hackdriver." The *California*, however, was equipped with "a machine for manufacturing fresh water from salt, but it takes more wood to supply it with fuel than the price of the same amount of water would be in port."

A month before the *California* reached Valparaiso, Sanger noted that "the general health of our company is good," and at the Chilean port the ships' passengers had their fill of fruits and vegetables, "radishes, turnips, onions and cabbage, peaches, plums, oranges, nectarines, bananas and plantains." Less than two months later they landed in San Francisco.

The Reverend James Wood,[93] a somewhat neurotic minister, traveling with his wife and three small children and their German nurse, provides a picture of abject craving for fresh fruit on reaching Rio de Janeiro. He had suffered severely from seasickness, almost from the first day out of New York on 9 May 1849, so that his diary reads like that of a veritable floating John Donne. He forgot his Christian humility, as he reproached himself later, and "was the *first* in the *first boat* to go ashore," adding to his list of "firsts"—"the first thing I did was to buy some oranges; this would seem almost silly, but when the stomach has been deranged for six or seven weeks and nothing but salt provisions, or little else but salt provisions, the appetite longs for fresh meat and land food."

Still afloat four months later, 16 September, after a protracted lay-over in Rio, The Reverend Mr. Wood confides in his journal: "I am becoming more and more irritable. I think my nervous system has become deranged. Satan is again in a supremacy. It is most

mortifying." By 2 November, both he and his wife were suffering from chillblains.* No further complaint of this nature is to be found after the landing at Valparaiso, and by 14 January he was wading through the muddy streets of San Francisco's water front, carrying his and his family's belongings, because "hiring conveyances and porters is almost beyond means." In the subsequent volumes of his diaries which continue until 1875, recounting his missionary endeavors in California, no actual mention is made of scurvy.

Williams,[90] traveling the same route in the ship *Pacific* and in the very same sailing time and arriving only a few weeks later than the *Charlotte,* praised the food but fell victim to dysentery within a week after landing in San Francisco. He records the death by scurvy of passengers on the ship *Brooklyn,* which had arrived two days before the *Pacific* "with a good many cases of scurvy, three of which proved fatal upon sight of land." A week later, 22 August 1849, Williams reports "more deaths [from scurvy] among passengers" of the *Brooklyn.*

Aboard the *Pacific* one of Williams' fellow passengers was Dr. Stillman, who was to encounter scurvy three months after landing on his trip to the Feather River mines. A violent critic of the *Pacific's* despotic Captain Tibbets, against whom charges were filed with the United States Consul at Rio, Dr. Stillman, who later became one of the most prominent physicians in San Francisco, served as spokesman for the complainants, demanding redress against both the skipper and the co-owner of the *Pacific,* a Mr. Griffin, for failure to provide the "good cabin fare" agreed upon and permit passengers "to eat at the same table with the owners and their families." Captain Tibbets was removed from command and, on arrival in San Francisco, fined $125 for assault according to Williams' journal.

The *Pacific* sailed from New York on 24 January 1849. Of dinner the first day out Williams wrote: "Good dinner, tender roast beef, ham, potatoes, etc. I never ate more in my life." The second day, the "Captain knocked in a barrel of apples which went in a hurry." For breakfast Williams had "three pieces of beefsteak, one of ham, with coffee, bread, etc." The "cuisine honeymoon" lasted another week with a notation regarding "a fine chicken pot pie, with rice pudding," and Captain Tibbets knock-

* Scurvy intensifies susceptibility to chillblains, according to Arctic explorers and more modern experiments on cold injury.[26]

ing in the head of another barrel of apples and the scramble of the passengers for them, "all hands dive for them regardless of consequences to clothes and limb. . . ." Williams admitted getting twelve for himself.

A week later however, by 10 February, the clashes with Captain Tibbets over the food began in earnest, forcing him to post the week's bill of fare in advance, so that, exactly a month out at sea, on 22 February, Williams writes: "We are longing for the luxuries of Rio." Three weeks away, at Frio Grande across the river from Rio, "oranges, lemons and limes costing 50¢ to 75¢ per 100" were taken aboard in great quantities. Captain Estherbrook had taken command, and at Callao, Chile, on 1 June, the ship's larder was again replenished, not only with fresh fruits of all sorts, but with a "misc'l assortment of pigs, sheep, turkeys, cabbages, pumpkins and potatoes," so that three days later, 11 June, diarist Williams writes:

> Grand dinner today! First came soup, mock turtle and vermicelli, then roast beef, turkeys, lamb, mutton, chicken salad, mackorine, lima beans, sweet potatoes, squash, current and other jellies, applesauce, etc. Then apple and pumpkin pies, tarts and puddings, and ale in abundance to wash it all down. Then oranges and bananas and last but not least the best champayne, which put us all in excellent spirits. The utmost harmony and good feeling prevailed.

Small wonder that one Argonaut recorded in his journal[34] a weight gain of 23 pounds! On leaving Boston aboard the bark *Elvira* William H. Herbert weighed 135 pounds; at Rio his weight was 144 and on landing at San Francisco, 158 pounds. Another wrote with resignation, "I believe after we land we shall be able to eat and drink anything."

Enos Christman,[13] the Westchester, Pennsylvania, printer-partner of Sonora's Dr. Lewis Gunn, wrote an excellent set of memoirs. He rounded the Horn in the *Europe*. The 51 passengers, "6 of them ladies," were hardly aboard when they were busily engaged "curing a lot of cabbage bought for their own convenience," and "paring onions to put them down in a barrel to pickle." His first Christmas, in California, Christman records as follows: "Now, eleven o'clock, all is quiet and while I have been writing, my old comrade, Atkins, has made drinks of lemonade. I now take up my bowl to drink 'a happy Christmas' to friends we've left at home!" Appropriately enough, this toast was drunk in Sonora, which owed its corporate existence to an epidemic of scurvy.

The 700-ton *Edward Everett,* named for the president of Harvard who presented the ship with a library of one hundred volumes before it departed from Boston, carried one of the best organized and financed expeditions to California. The ship stocked provisions for two years and large stores of merchandise, but nevertheless many of its three hundred passengers were "in the incipient stages of scurvy," according to Shaw.[75]

The Reverend Mr. I. A. Benton, Congregationalist graduate of Yale, was one of the first to make the Gold Rush voyage around the Horn. He was aboard the *Edward Everett,* whose voyage was well chronicled by Enoch Jacobs,[41] to whom we are indebted for the description of the cook's *pièce de résistance* of the voyage, "composed of 3 parts Parsnips, 2 parts Rutabaga turnips and 2 parts Codfish," which bore "the significant name of 'Hushamagrundy'."

New Englanders, with confidence bred of long acquaintance with whaling men and more recent China merchantmen, preferred the sea routes, either the long voyage round Cape Horn or via the Straits of Magellan or the shorter ones across Nicaragua and Panama. The latter, with its fifty-mile overland break, also had the advantage of supplying tropical fruits to the Yankee diet. The "Isthmus voyages" occupied little more than a month if all things went well and connections were made at Panama City, Realejo, or the other Pacific ports for San Francisco. Scurvy can almost be eliminated from the Isthmus voyages, and nowhere in the dozen or so journals of these broken voyages do we find any references to it. For example, Waldron[88] made the trip from Massachusetts to San Francisco in fifty days via Panama.

The well-known voyage by the group of young Yale graduates of 1848,[3] aboard the Gordon Passenger Line, via Nicaragua and Realejo, certainly was not in danger of "scorbutic taint" if one were to believe the sample bills of fare which Roger S. Baldwin, Jr. received with the receipt for his $150 advance payment for passage aboard the *Mary* and the *Plutus.* All seemingly went well from New York to Nicaragua for the *Plutus* was a "fine little brig," but at Juan del Norte troubles began. After weeks of waiting for passage to San Francisco the "Sons of Eli" chartered the *Laura Ann,* a 100-ton brigantine which had a somewhat sinister piratical history it was unable to shake off. They were blown off their course and took 144 days to reach San Francisco on 3 October 1849. During this time they were obliged to subsist for two weeks on "half softened rice and a pint of water a day," and for twenty-two days

more on "three mussels and the water distilled through a gun barrel," which speaks well for their adeptness at improvising a condenser of a most unusual type.

Circumnavigation of the entire South American continent took almost six times as long as the Panama route. Passenger accommodations for both of these were limited, while the overland route offered no hindrance to numbers, save supplies of wagons, oxen, mules, and foodstuffs. These, too, seem to have been quickly forthcoming at Chicago, St. Louis, St. Joseph or Independence, Missouri, when the emigrant was found willing to pay the price demanded by the outfitters.

In 1849 the Horn was rounded by more Americans than in any previous year,[64,70] 775 vessels clearing Atlantic ports for San Francisco. According to records kept by Edward S. King, harbor master of San Francisco, 15,597 passengers arrived by way of "the Horn route" and 6,489 came by way of Panama. An additional 9,217 arrived from other Pacific ports—a total of 31,303—half of them going around Cape Horn.

Australia was only fifty sailing days from California and Australians "beat the Americans to the diggings." More Australian than American women arrived in California the first year.

The occurrence of scurvy after the emigrants arrived "in the diggings" forms perhaps the main chapter of the Gold Rush saga. Evidence for it is not easy to gather. Miners were, for the most part, too busy to keep diaries and journals, or too fatigued to write home more than an occasional letter which was sent at great expense. Cold, damp tents and feeble candlelight after a day in the icy mountain streams and creeks offered little or no inspiration to the weary men. Then, too, letters once sent became for the most part ephemera and were lost as historical evidence. Only a relatively few survived, chiefly because the "folks back home" offered them to the local newspaper for reprinting as first-hand news from the California *terra incognita*. Still more rare are complete files of letters kept by families.

The occasional letter which mentions scurvy as occurring either in the writer himself or in his mining camp is even more significant than one would at first believe. If fresh provisions were unobtainable by the letter-writing miner of Drytown, for example, in the winter of 1849, it is almost certain that his fellow miners were, as he put it, "in the same boat." Life in the early mining camp, lacking immediate family ties, engendered under red flannel shirts

a very charitable spirit of sharing. This is apparent as one reads contemporary accounts.

Letter writers were seemingly unwilling to worry their families with discouraging letters concerning their health, preferring to remain hardy and heroic adventurers in the eyes of those back home. The lassitude of acute scurvy was not conducive to letter writing, and when the sufferer recovered and returned to working his claim, he was quick to forget his illness, as can be seen from the letters of Captain David De Wolf.[19]

On 12 December 1849 he wrote his wife that he had been "taken with Colery Morbus [*sic*] but am getting better," and that his companions were suffering from scurvy, while in his 20 January 1850 letter he casually remarks "I have had the Scurvey [*sic*], a complaint that is very common here," adding that he is now "more fleshy than you ever saw me." By May 31st he gives his weight at 240 pounds, adding that he had "quit mining, I cannot lift the heavy rocks." De Wolf returned east to farm in Illinois in 1851, and died heroically as a captain of infantry under Grant, refusing to permit his men to carry him from the field when mortally wounded during the Battle of Corinth, 3 October 1862.

Occasionally, one finds references to scurvy in letters of '49 vintage, sometimes in association with other diseases, which indicates its well-known tendency to weaken resistance. One such letter, from a miner named "Mifflin," written from "Dry Diggings City," on 25 October 1849, is printed in the St. Louis *Reveille* and quoted in the St. Joseph (Mo.) *Adventure* of 8 February 1850:

> It has been somewhat unhealthy here for the past few weeks. The prevailing disease has been diarrhoea and scurvy. A number of people are now complaining of bad colds. Three or four deaths occured [*sic*] from scurvy. It is almost impossible to obtain any vegetables here. This is the first time in my life I have seen vegetables retail by the pound. The man who purchases a bushel is looked upon as a heavy operator! It is not to be wondered at that those just arrived from the sea or plains should suffer from scurvy.

In Sacramento, according to a letter from Sutter's Fort, written on 24 January 1850, the death rate had been "18 to 20 per day for the past five months," and the "diseases most common are the scurvy, complexed with rheumatism, dysentery, and typhus fever." "Scurvy has been the poison bane of the last emigration," the letter continues, placing the blame on "side bacon, hot lard, saleratus and (soda) biscuit."

While most of the scurvy cases reported in letters seem to date from the fall of 1849, J. D. Stevenson[80] writing to his son-in-law, James H. Brady, in New York in April 1849 says: "I am advised that scurvy has broken out in some parts of the region and is making fearful ravages," indicating that scurvy occurred in the spring of 1849 as well.

"Salt and greasy provisions without vegetables," are blamed for scurvy by William Kelly[44] who gives a vivid description of gangrenous types he had seen, accompanied by ecchymoses.

The writer of the Shufelt[77] letter, dated 3 March 1850 and written from Placerville, now the center of a rich fruit belt, tells of the suffering from scurvy during the rainy winter of 1849:

> We pitched our tents, shouldered our picks and shovels and with pan in hand sallied forth to try our fortunes at gold digging. . . . Wm. Ramsdell and Cooke of our party were sick with the scurvy and could not work. This is the worst disease that we have to contend with here, it settles in the legs and ankles, making the person quite lame. The skin turns purple and if not arrested soon, spots will decay and fall off leaving a running sore. It is brought on by eating salt food and no vegetables. . . .
>
> The wet [season] commenced about the first of November last, nearly two months earlier than usual. Many had not got their provisions up from Sacramento City and the roads became very bad. Hauling was 50 cts per pound with the prospect that soon all transportation would be impossible, consequently provisions ran up in price to an enormous height. Flour and pork were $125 per Bll., lard & Butter $200 Bll., Cheese $1.50 lb., Dried Apples $1.50, Saleratus $5.00, Molasses from $8. to $10.00 pr Gallon and all other things about in that proportion. Potatoes and onions were worth $1.25 and $1.50 pr pound etc.

Two days later, Shufelt writes: "Hayes, Cornwell and Wm. Ramsdell have all died. The latter left the mines on account of scurvy and was taken with the diarrea, bloody flux and died in a short time," adding, "thus six of our little party have gone."

The eighty-four hitherto unpublished letters[47] of fifty-year-old John Thompson Kincade to his brother James and James' wife constitute a human-interest study in the development of what the late Sir Jack Drummond called "bachelor's scurvy." Kincade came to the American River "diggings" from Maryville, Ohio, in September 1849, and wrote lengthy letters over a period of fourteen years which his family "back East" faithfully preserved. In his third letter on 21 March 1850, he speaks of a winter of considerable sickness, of fever and scurvy, adding, "and when men become sick they most generally die." Two and a half years later he was ill with a fever lasting three weeks, paying $16 to $20 a visit to his doctor "for looking wise and shaking his head." Later Kincade introduces

his twenty-first letter with a parable, written in Biblical style, which forms an interesting bit of "scurvy lore": "Indian Valley—It came to pass that one was sick and wanted potatoes to eat and his brethren went and sought for potatoes until they found them at $1.25 a pound—in time he got well." Throughout his sojourn in the mines he suffered from rheumatic pains.*

One thing is well known—that the autumn and winter of 1849 were the rainiest in the history of the mining regions. In addition there were as yet no actual roads into the rapidly expanding "diggings." Most provisions had to be brought, at least for the last few rough, slow, mostly mountainous miles and across spate-swollen torrential creeks, by whaleboat ferry or by frail footbridge and on mule back at freighting prices compounded by scarcity.

A scurvy epidemic which swept through Sonora in the late fall of 1849 brought about the incorporation of this early mining camp into a town, according to official records:[86]

> On November 7 the citizens of Sonora, taking into consideration the sickly state of the camp, held a meeting to provisionally organize a town, namely to take measures to establish a hospital for the destitute sick, of which there were large numbers . . . the most prominent disease was land scurvy, a species of scorbutic complaint, differing somewhat from the sea scurvy. This complaint was exceedingly fatal, and was brought on by exposure and bad living, but above all by the quantities of fat from salt pork eaten by the miners to make their bad bread taste better. The want of fresh provisions and vegetables was another prolific cause of the disease. Persons sized with it were frequently dead in 48 hours; but if it took a favorable turn before that time, they generally recovered.

Charles F. Dodge, the camp's butcher as well as *alcalde,* and subsequently first mayor of the town (whose population Shinn[76] estimated at five thousand before the close of 1849), started the hospital subscription with a personal donation of several hundred dollars. When the initial subscriptions reached $779, construction was begun, almost the same day, the story is told, "nor was it a wit too soon, as numbers were brought in daily, many of whom died from sheer want of the necessaries and comforts of civilized life."

In the records of the County Supervisor's and the Recorder's office in Sonora today may be found the itemized bills for this nutritionally historic hospital, a sort of "California Haslar."† The

* Lemon or lime juice was a favorite rheumatism remedy among California's miners according to Loomis.[51] "Three wine glasses a day [are] a sure cure for rheumatism," the *San Francisco Golden Era* (XV, 5, p.7) advised its readers.

† Haslar Royal Hospital at Portsmouth, England, was the first naval hospital to be built; its first physician was James Lind.[4]

hospital's expenses, according to Shinn, "were enormous." In addition to lime juice** at five dollars a bottle, potatoes cost "one dollars and a half a pound; canned fruits and all anti-scorbutics were twenty-fold the usual prices."

As a result of incorporation of the town, vacant lots and unoccupied lands belonging to Sonora in its now corporate capacity were sold to the highest bidders, and the proceeds were devoted to hospital maintenance. This hospital was kept going until May when the torrential rains had subsided, and roads and trails became passable again and supplies arrived, including the fruits and vegetables from the South, or as Shinn put it, the hospital "was successfully maintained for six months, or until the ravages of scurvy were checked."†

Sonora's scurvy epidemic is also reflected in the private practice of Dr. Lewis C. Gunn,[29] the Philadelphia printer-physician, a veritable Californian Ulric Binder. Dr. Gunn records that on Sunday, November 18th (eleven days after the town meeting) he treated two Peruvians for scurvy. A few months later he credits scurvy with actually setting up his medical practice. On 17 February 1850 he wrote: "My business of late has been good indeed. During the past week I have received from new patients over two hundred dollars. . . . My increase in business has been owing to great success in the treatment of disease prevailing extensively, scurvy combined with stiff legs." A few months earlier he treated a Chilean miner for scurvy for a fee of two boxes of sardines.

Dr. Gunn's colorful career has been recorded by his wife in one of the classic journals of the Mother Lode, which almost ranks in importance with the Dame Shirley[14] letters in providing a picture of pioneer family life in the mines. These two women "historians" were both wives of physicians. From Mrs. Gunn we learn that Sonora still suffered from shortages of fruits and vegetables in 1851, for she says on 10 November: "We have no fruit raised here. An old man brings us tomatoes and turnips from five miles away—and pears, small ones, at 25 cents apiece."

** Lime juice was usually put up in six-ounce bottles and shipped from Baja California. Ironically, John Sutter, Jr., son of the man on whose property in Coloma gold was first discovered, furnished lime juice to its California miners as well. He early planted a grove of lime trees, the orchard reaching 20,000 and yielding as many boxes of fruit per month, on his Los Organos ranch near Acapulco. Recent evidence, however, points to a later date than 1850 for this large-scale planting by Dona Nicolasa, Sutter's second wife.

† The writer found the first street map of Sonora among the courthouse records of Tuolomne County and so located the site of this first, and possibly only, hospital erected to treat scurvy. It stood on the corner of Hospital and Vigilance Streets, diagonally across from the pioneer Hebrew Cemetery, with its gravestones dating back to 1850.

A year later, 17 October 1852, we find her making tomato preserves, and Dr. Gunn's knowledge of household antiscorbutics seems to have pervaded his wife's recipe: "I sliced some [tomatoes] and boiled them down in the syrup—put some sliced oranges in too, and Lewis [Dr. Gunn] thinks they are fine." Mrs. Gunn also devised a pie of green tomatoes for her family.

Journals and diaries of the Gold Rush kept by women are relatively scarce, for the simple reason that women themselves were scarce, and the few who had survived the hardships of travel and accompanied their husbands into the pioneer life of the mining camp had little time to write diaries or letters. When they did, their jottings are far more incisive regarding food and food habits and yield a clearer picture of nutrition of that day than those of the men diarists.

Luzena Stanley Wilson[91] reveals the chivalry with which storekeepers treated women in early mining camps: "I was a woman with two children," she recalls her stay in Sacramento in 1849, "and I might have bought out the town with no security other than my word. . . ." And she later remarks: "Many a miserable unfortunate, stricken down by the horrors of scurvy or Panama fever, died in his lonely, deserted tent and waited days for the hurrying crowd to bestow the rites of burial."*

An Iowa emigrant, Catherine Margaret Haun,[32] tells of the precaution of including "citric acid—an antidote for scurvy" among the provisions while traveling across the plains in 1849, and that "for luxuries we carried a gallon each of wild plum and crabapple preserves and blackberry jam." Her journal records no case of scurvy on the trip. She recalls paying a dollar for a serving of cabbage for her Christmas dinner in Sacramento, the side dish to a grizzly bear steak costing $2.50.

The Carpenter diary[12] of travel by ox team places reliance on vinegar as an antiscorbutic. The writer records a craving for fruit after the two-and-a-half-month journey and adds: "How we do wish for some vegetables. I can really smell them cooking at times." At Fort Kearney Mrs. Carpenter's husband purchased canned peaches and blackberries at which she remarks: "I am lucky having a Yankee for a husband—so I am well waited on."

Even the pioneer woman's meager knowledge of dietetics was early put to work, not only in providing for the antiscorbutic needs

* The Wilson memoirs were edited by a daughter, Mrs. Correnah Wilson Wright, who graduated from Mills College in 1875 and became its first alumna trustee.

of her family, but commercially, as in the case of Mrs. Peter Wimmer, wife of one of Sutter's employees at the Coloma sawmill. Today a few ancient pear trees, remnants of the century-old "orchard" which Mrs. Wimmer planted around her cabin, bear evidence of the legend that "she sold the pears from these trees to miners at $1 apiece," and that, so eager were the Coloma miners for fruit, she had to resort to tagging the unripe pears with the name of the miner who had paid her in advance for them. The Wimmer cabin's fireplace and chimney and the pear trees are all that remain today to remind us of this pioneer woman who not only witnessed the discovery of gold but provided the lye she had prepared for making soap to assay the first flakes of gold James Marshall found in the mill's tailrace.

Even the wives of physicians, guided perhaps by their husband's dietetic knowledge, became "kitchen-sink apothecaries" where anti-scorbutics were concerned. Mrs. Mary Jane Megquier and her physician husband, who was graduated from Bowdoin College in 1827, were planning to move to Hawaii when news of the California gold discovery hit the East. They were among the first to cross the Isthmus of Panama and arrived in San Francisco in June of '49. The thrifty wife of this Winthrop, Maine, physician took in boarders to pay the house rent although, as she says: "The Dr often makes his $50 a day in his practise and great profits on drugs." Then she adds, "To show you some of the profits in retail, the Dr bought a half barrel of pickles in salt, after soaking them I put up fourteen quart bottles, sold them for $6 more than we gave for the whole, which still left me the same bulk I had at first."

For the student of racial food habits the outbreak of scurvy among Sonora's Mexican population is somewhat difficult to explain. Fondness for raw onions has long been known as the secret of the Mexican's resistance to scurvy, just as the "undercooking" of vegetables by Chinese and their use of sprouted legumes no doubt contributed to their higher vitamin C intake over the Yankee American and Cornish miners' "salt bacon and beans."

Rarely does one find specific reference to scurvy in predominantly German mining camps. With scientific hindsight the nutritionist can attribute this to the freer use of potato salad, its lower pH protecting the ascorbic acid of the potatoes against rapid oxidation. We have found one German mentioned specifically and that in the diary of Dr. Charles R. Parke,[62] a University of Pennsylvania graduate of the class of 1847. In May 1850 he "was called

across the River" [at Bidwell's Bar] to see a young German who was scorbutic and whose "diet was quite simple, bread of their own making and bacon." (Incidentally, Dr. Parke was a member of the Como, Whiteside County, Illinois, party crossing the plains in 1849, and had prided himself on doing what "no other living man did." On 4 July, his party reached the South Pass where it was snowing and hailing. Using the milk of two cows, he had ice cream flavored with peppermint oil from his medicine chest. "It was delicious!" he notes in his journal.) Another miner with a German name, Benjamin Richtmeyer,[1] survived "Drytown's epidemic of scurvy," as the contemporary accounts refer to it, in the autumn and winter of 1849 and lived to be 102 years old. Nor did scurvy at 24 shorten the life span of a Vermonter named Woolley[94] of Weaverville who lived to the age of 91.

Scurvy, it would seem, appeared most frequently after the Argonauts of '49 reached the mines and were subjected to physical exertion while undergoing ever more severe depletion of vitamin C than they had suffered aboard ship on their journeys around Cape Horn. We find this exemplified in the Kent[45] journal, the record of a group of New England emigrants calling themselves the "Shawmut and California Company." They had purchased the *Rodolphe,* taking it around the Cape without a case of scurvy among the sixteen members during the seven-month voyage to San Francisco. Within a month after landing, however, Kent writes, "almost all of us have diarrhea or dysentery," adding: "I little thought that the first digging I would do in California would be digging a grave"—this for Andrew Watkins, one of Kent's company. A few days later they buried Charles Stearns alongside Watkins. Dysentery was regarded a concomitant of scurvy with which, Kent writes, "nearly all of our party excepting myself were troubled, during this winter [of 1849]. "Captain Snow was very much affected with this disease, but finally drove it away by the free use of potatoes, vinegar, etc."

One of the company's liveliest members, a Boston hatter named Thomas Le Moyne, whom Kent had early in the voyage singled out as a wit, died a victim of scurvy. Kent gives us a poignant description of Le Moyne's case:

> He was taken sick a short time after his arrival at the mines and continued to decline gradually until the morning of December 28 when he died. I hardly knew what to call his disease but the doctor said it terminated in scurvy. It seemed more like quick consumption than anything else. I cannot say that he had the best of medical or other attendance, but I do

think that the disposition was not wanting to do what lay in our power towards saving his life. We dug a grave on the hill near our home, sinking it a foot or more into the rock. I read the funeral service.

Similarly, in the Huntington Library's beautifully illustrated holograph diary of watercolorist Hovey[37] no mention of sickness occurs during the brig *Charlotte's* six-month journey from Newburyport, Massachusetts, but three months later, in the mines of the Mokelumne River, Hovey makes this entry: "Oct. 9: We had a visit from Captain C. Wardwell, who informed us that M. Trimey had died of the scurvy."

Dr. Ferguson's[22] journal gives one of the most vivid descriptions of land scurvy to be found anywhere. It is worth quoting *in extenso* since the treatment prescribed by Dr. Gardner, his physician, virtually ran the gamut of the antiscorbutic armamentarium of that day:

For a long time I had been feeling that something was wrong with me. I had never felt so before—sluggish, tired, lazy—the latter I had never been guilty of before. Finally my gums got sore and began to bleed, and I became subject to excruciating pains. The boys sent for Dr. Gardner, who pronounced it scurvy, contracted in crossing the plains, induced by exposure, anxiety of mind and starvation.

He prescribed spruce boughs[53] boiled to a strong tea, which I was to drink, and nothing else. A wash of the same with vinegar and tinctured with cayenne pepper including a steam bath of the same, at a pretty high pressure, were the doctor's directions to the boys for my daily treatment. It was pretty tough treatment, harder to bear than any I had ever inflicted during my professional career among my Oregon patients.

I was put through the steam kettle process by the boys for ten days; was helpless as an infant, having to be carried to and from my bed. The painful part of my affliction seemed to be in my feet and legs. The only way for a long time I could get at ease was in lying on my back on the floor and putting my feet on the table, a luxury I dearly paid for afterwards, for when I came to put them on a level with my body, the pain was still more unbearable. I would pity the meanest dog in the world that had the scurvy.

But thanks to Dr. Gardner, the boys, the steam kettle and raw potatoes sliced in vinegar, after some two weeks my pains left me, and "Richard was himself again," though rather thin and scanty, for I could put my finger on the calf of my leg or on any part of my body and press it to the bone, and the indentation would remain for half an hour, and when the flesh or skin resumed its smoothness again, a black spot would mark the place of the pressure.

If my readers think the above description of scurvy treatment unnecessary, my apology is that it is for their benefit; should they ever get a little mangy and unable to get a doctor, they can avail themselves of the prescription in my case. As I have lived to tell the story I venture to pronounce the above remedy, in the language of learned Sierra Nevada doctors, a "never failing antiscorbutic."

Ferguson's craving for raw fruits and vegetables, and the prices they sold for are graphically told in this journal:

> One day, while walking through the market of Marysville, I saw some pears for sale. I had seen no fruit yet in the country. All my boyish appetite was aroused. I took one and ate it and was about to take another, when it occurred to me to ask how much they were apiece, at the same time pulling out a silver dollar to pay for the two. It somewhat jogged the intellect when in a modest and innocent way I was told that they were only $2.50 apiece. I suddenly discovered that the one I had already eaten was sufficient for me at that time. I paid for it and walked on to meet a vender of onions, who told me that he was disposing of his vegetables for the remarkably low price of $3. a pound. I purchased of him one good large onion for $2. and ate it raw, and thought I had never before tasted anything half so delicious.
>
> Up to this time there had been no fruit imported into the country, except dried apples and peaches, which were to be had at one dollar a pound; dried Chili beans at the same price; pickled peaches at $16 a gallon; jar onions and cucumbers and other like pickles at $8 per half gallon jars. So it is manifest that one had to make something to live; yet scarcely anyone ever stinted himself even at the above prices. Board was $21 a week at the most common boarding-houses. The food was mostly pork and beans, plenty of bread and beef, the latter the cheapest article of food in the country; dried apple sauce, tea and coffee, and all this ample bill of fare for $21 a week, or for $1.50 per meal. Such was the case wherever I went, up to the summer of 1851, when garden vegetables began to be raised plentifully. I remember paying one dollar a pound for potatoes. We could not afford ourselves the luxury of eating them boiled, but used to slice them up like cucumbers, with vinegar. This was not for the love of them in this style, but as a preventive of scurvy. When potatoes got down to $30 a hundred pounds, myself and another bought each a hundred pounds, and carried them on our backs three miles, thinking we had a great prize.

By far the most accurate lay self-observation on scurvy encountered in our reading of Gold Rush documents is contained in the six volumes of records left by G. W. Evans.[21] A native of Defiance, Ohio, Evans made the overland trip via New Orleans, Chihuahua (Mexico), Los Angeles, and Stockton to the mines near Mariposa, starting his trip on 20 February 1849. He arrived at his destination the day after Christmas and was unable to work because of a "bilious colic." A week later "pains in chest and stomach increased" and on 19 January 1850, he was again "confined to his house, unable to work, caused by a cold, extreme soreness of all the bones of my mortal frame, and attended with the evils of constant dioraethea [*sic*]. I am almost at a loss for medicine. The mercurial medicines have salivated me." An apple pie, baked by a friend, "was the only food relished," and the alcalde sent him "a piece of beef and a hand full of dried sasafras [*sic*] roots, brought by him from Missouri."

Evans' almost day-by-day account of the onset of scurvy is recorded herewith:

Jan. 30. Still unable to labor, time passes heavily.

Jan. 31. Suffered much through the night with pain in the head. The chilly damp seems also to exercise an influence upon my rheumatic bones.

Feb. 2. I wandered a mile from camp, picked up several pieces of gold and returned almost worn out with the pain and fatigue of my walk.

Feb. 4. I went out to work and found gold enough to pay my expenses. My labor, however, attended with much pain in my joints.

Feb. 7. My sufferings are at times almost intolerable, but attended court as a juror.

Feb. 12. Still unable to work and I have applied one of the remedies furnished by nature, to wit: a plaster of gum of the pine, but have not yet experienced much relief to my aching back and joints.

Feb. 14. My disease is no better and I applied to Drs. Hoar & Meridith who pronounced my case "scurvy," that bane of these mountains. They advise me to get all the vegetables afforded in these hills as long as I remain but go to the coast at the first opportunity. To put their prescription into practice I sent up the side hills and had some wild cabbage and a small wild onion brought down and purchased a bottle of lime juice and some potatoes.

All these vegetables I use now, with the juice of lime and most sincerely hope this change of diet may be productive of a cure. This cabbage found growing here tastes like cress, and resembles the plant found in the garden of our German population back home and known by them as "kale." The only difference the leaf is much smaller. It makes, however, a most luscious sallad with the lime juice and a little sugar.

Feb. 16. My health is improving. A sudden change in diet is fast removing the cause of my dismal aches and I shall yet take the liberty of describing all the symptoms of this terrible disease.

Apr. 7. I am getting better of my scurvy every day, my cold upon the lungs is also easing off.

Nov. 3. Fever again has come upon me and am under the necessity of taking more medicine.

Nov. 4. Another feverish night—worked under severe pain.

Nov. 5. Great sufferings over whole body, applied to Dr. Hardenstren, Homopathic Phy. [*sic*].

Nov. 6. Fever abating. Quit board at the Brannan house for the simple reason that such a diet as was ordered by my Phy. they would not provide.

A note inserted in the sixth and final volume under date of 16 December 1850 states "Mr. Evans died this day."

Physicians were numerous among the gold seekers. The ship *Pacific* had a ratio of better than one doctor to twenty passengers (5 in 95, to be exact). Hardly a "company" of wagons started out but one or two physicians, whether bonafide or "self-degreed" doctors, went along. In their memoirs, journals, diaries, and letters, one finds frequent mention of scurvy. As with earlier medical writers on the subject, not everything termed so was scurvy.

The classic paper on land scurvy in California[50] is that of Dr. Thomas Muldrop Logan* who himself rounded the Horn in a 75-ton schooner. It is the first long, and somewhat long-winded, account of scurvy in the mines and is one of the first medical papers to be published from California, subjoined to a letter dealing with cholera. As a staff member of the Charity Hospital in Charleston, Dr. Logan had had ample opportunity to observe scurvy at first hand among the immigrants fleeing Ireland during the potato famines of the 1840's, and to study cholera in New Orleans where he "held a comfortable position" before coming to California. Although he categorically states that he observed no difference between land and sea scurvy, he becomes deeply absorbed in its hematology. It induced him to make the interesting observation of the "lack of a saline taste when the blood of scorbutic patients is applied to the tongue."

A climatologist at heart, Dr. Logan had read Lind[48,49] and states that "Cold and moisture, hitherto regarded as the most powerful predisposing causes, have had no share in the production of the disease [scurvy]," but "that insufficiency and unwholesomeness of nutriment, with the super addition of excessive fatigue, want of cleanliness, and moral suffering and disappointment, are the most active agents in its causation and excitation."

After such modern sounding medical language and thought, involving physical stress plus psychosomatic pressures in precipitating scurvy caused by an improper diet, Logan's paper is somewhat disappointing. It gives us no statistical or epidemiological account although he traveled widely through the mining districts. (Later he became the first Secretary of the California State Board of Health and President of the American Medical Association in 1872.[30]) He employed a chemical test and treated the dark blood of scurvy patients with various antiscorbutic remedies then in use, much in the manner in which Beddoes[5] and MacBride[57] had done a century before to what they regarded as scorbutogenic foodstuffs themselves. Nowhere do we find Logan employing the far more scientifically worthwhile titration of scorbutic urines and bloods with "vegetable blue" described by Paterson[63] fifty years before. "Neither nitric, hydrochloric, acetic or citric acid produced the Stevens reaction, and sodium and potassium hydroxide, too, failed to produce the 'Modena-red' color" obtained with potassium and sodium nitrate,

* A native of Charleston, South Carolina, and a graduate, at twenty, of Charleston's Medical College with further studies in London and Paris.

Logan writes. He carefully adds that these latter two, positive *in vitro* in his experience, were "inadequate to effect the same changes in the *liquor sanguinis* of the patient when administered internally."

Using the terms "fermentation and putrefaction synonymously" Logan finds himself involved, as did Sir John Pringle,[66] in fitting the theory of "food putrescency" as a cause of scurvy into the preservative effect of salt upon food, and thus moralizes about Pringle's quandary. "Observe, he did not attribute the disease, as is commonly done, to the salt in the food, because he knew well that the important ingredient of healthy blood was antiseptic, and calculated to retard rather than to accelerate putrefaction." Logan also observed what Lind[48] and other earlier writers[52] had pointed out in scorbutic seamen recruited from almshouses, that "old ulcers and wounds long cicatrized break out afresh" and "there is one disease only entitled to the name of 'scurvy,' that is the same by land as upon the sea, depending everywhere upon the same causes."

Since medical evidence may be regarded as more valid than that of laymen, the contemporary clinical observations of a practising physician on scurvy are extremely interesting. Dr. Praslow[65] arrived in San Francisco in June 1849 after a trip around Cape Horn, such as Dr. Logan had made more than a year earlier. This is of importance in that Praslow was among the first medical men on the scene, when San Francisco's tidewater Montgomery Street was as yet paved only with barrel staves and stove-tops over which the embarking emigrant had to carry his belongings. Praslow also recognized the sudden stress to which these men were subjected—both physical and mental—and included it in his picture of scurvy. His "timetable," too, is interesting for comparison with that of Crandon a century later.

Praslow calls scurvy "the most prevalent disease" with which he had to deal, both on the sea voyage and ashore. He analyzes the appearance of scurvy aboard ship very carefully:

> On our voyage from New York to Cape Horn, as far southward as the mouth of the Platte River, we had no scurvy on board, but only after we approached the coast of Patagonia did several cases appear. At the start, these ran a mild course. . . . When, however, for seven weeks we were unable to round Cape Horn and were tossed about by severe storms in the vicinity of the eternal icebergs, far to the south, latitude 64, the food became less plentiful and the cold which we had to endure became severe, together with a shortage of water, scurvy increased considerably, so that 25 of 200 aboard were afflicted. . . . After we had fortunately rounded Cape Horn and were able to take fresh foodstuffs aboard at Valparaiso and the Island of San Juan

Fernandez, scurvy subsided, only to break out again so severely that half of our passengers and crew came down with it. . . . During the remainder of our voyage to San Francisco scurvy gradually subsided, only to break out afresh and with increased severity after we stepped on land. . . . in fact, almost all ships we saw arrive in San Francisco, after Cape Horn voyages, had a considerable number of patients aboard in whom flagrant scurvy developed *on landing.*

Earlier writers[52] had observed this outbreak of scurvy after sudden physical exertion. The early emigrant reaching San Francisco harbor often was forced to drag his trunks and other belongings off the ship through quagmire streets, because of the shortage or nonexistence of porters, or because of the exorbitant prices charged for such service. This sudden exertion after six months of virtual confinement aboard ship conforms to the pattern of the modern concept of stress and its relationship to the suprarenal, and the latter's dependence on the antiscorbutic vitamin.

Praslow, too, was interested in the hematology of scurvy, not as much in blood morpholysis, like Logan, but in hemorrhagic manifestations. In introducing the discussion of scurvy he remarks:

At the beginning of my practise [in San Francisco] in June 1849 I was for sometime still occupied with the sick from our ship. I shall single out only the patients with scurvy. Upon landing, the scurvy patients were given moderate* amounts of meat, many vegetables and dried fruit, since fresh were not to be had. We used vinegar and water ablutions and malt baths, and ordered as fluids beer, porter, wine, and administered internally mineral and vegetable acids, particularly tartaric, citric, sulphuric, hydrochloric and acid of scurvy grass (cochlearia).[59] The most effective available remedy was scraped potato, ordered to be eaten raw, and also applied as a poultice on edematous and ulcerative parts. Brewer's yeast was also used in poultices and given by mouth, as well.†

Praslow condemned the "careless American use of harsh laxatives" and attributed the "most murderous diarrheas to the taking of jalap and epsom salts" by persons already weakened by scurvy or diarrhea. "They usually died in a few days," he adds, laconically. "In many patients, ulcers developed on the extremities which readily became gangrenous, and those already weakened by diarrhea and dysentery became steadily worse. It is no wonder that a

* Cordes' English rendition of Praslow's book often fails to convey the German physician's original meaning and translates "Graden" as "dangerous places" instead of "gradations" in the account of a metrorrhagia he associates with scurvy: "A woman from our ship experienced such a severe menstrual hemorrhage the second day after landing that only the most strenuous treatment measures saved her life." Here, again, Cordes translates the German word "maessig" (moderate) with "massive amounts of meat."

† This is the earliest record we have encountered of brewer's yeast used as a dietary supplement.

considerable number of them died. I saw fifty such patients die in one month in Happy Valley.‡

Supportive treatments for rapidly failing scorbutic patients included the folklorish* "burial in sand" and medication with quinine and arnica.

The German-trained physician remained in California for six years before he returned to Goettingen. He collected considerable data on cholera, bilious (malarial type) fevers, smallpox, and remarked that he had observed not a single case of rickets and only two cases of lobar pneumonia during his stay in California.

To Praslow we owe the first and most accurate descriptions of hospital facilities in San Francisco. According to him, the San Francisco City Hospital of 120 beds was established early in 1850 and was twice destroyed by fires (1850 and 1852) in which patients lost their lives. Rebuilt, as a more extensive structure with 250-300 beds, it stands with the newly erected stone U. S. Marine Hospital (400-500 beds) on Rincon Point. This latter provided medical care for men of the American fleet and was "open to sailors of all nations trading with the United States." In addition to these public institutions San Francisco early had a 30-bed German Hospital associated with the German Relief Society, a French Hospital, and several private institutions.

Hospitals were regarded as profitable investments. A letter[73] written in December 1848 by Robert Semple, the speculator-developer of Benecia, which he and M. G. Vallejo believed could be made to supplant San Francisco as the harbor for the impending avalanche of trade, pleaded with Consul Thomas O. Larkin to invest $5,000 worth of lumber in the construction of a hospital, promising that the investment would amortize itself within a year, adding that "another year will teach the sick" at the mines to take better care of their health.

‡ "Happy Valley," as the land adjoining the southern beach of San Francisco leading to Rincon Point[65] was known, was apparently Praslow's first office site.

* Loomis[51] mentions many well-known and truly antiscorbutic remedies, but only as remedies for rheumatism, since leg pains were common among the miners who worked for long hours standing in the cold water of the mountain streams and creeks, panning, washing, and wing-damming or sluicing. Leg pains, whether of scorbutic origin or not, were classed among the rheumatisms, and antiscorbutics, particularly lemon and lime juices, came into vogue as "anti-rheumatic remedies." Nowhere, however, in miners' medicines is mentioned the North Carolina mountaineer's folklore[51] prescription—"charcoal and salt, in equal proportions, is a sure cure for scurvy"—despite the fact that many of the first California miners were Carolinans. The Carolinas had had a gold strike already, as did Louisiana, and early sent experienced miners into the Western gold fields.

San Francisco's City Hospital* was not a municipally operated institution at the outset. Its treatment of scorbutic patients comes under the indictment of the Reverend Mr. William Taylor[83] who landed in San Francisco late in September 1849 after a five-month journey around Cape Horn.† He was the first Methodist minister to be officially assigned to California. He prided himself on being a street preacher. Virtually refused admission to the hospital by the medical staff, the Reverend Mr. Taylor[83] says he finally argued his way into the frame building crowded "with scurvy patients . . . many of whom had been on long voyages, living for months on what the sailors call 'old junk' and shipbread." Realizing that the patients were lacking the proper dietary care he addressed them as follows:

"My friends, what are you doing here? You are cooped up in this miserable place, without fresh air, without sunshine, without exercise, and without vegetable diet. You will die, the last man of you, if you don't get out of this place. You had better be turned out in San Jose Valley to graze, like old Nebuchadnezzar, than pine away and die in such a place as this." Now, said I, "I'll tell you what will cure you. On these sand-hills back of the city there grows a kind of wild lettuce," which I described to them. "If you will go out and gather that lettuce and use it, with a little vinegar, it will cure you." I knew the open air, and sunshine, and exercise would help them and believed the prescribed salad the best thing for them within their reach.

It was an interesting sight to see those poor fellows under the inspiration of a new hope crawling out and scrambling up the hills in search of my prescribed cure. The next week, when I called again to see them, I was really surprised to see how much their condition had improved.

In scurvy, as in court, medical evidence may be regarded as "direct testimony" while that of the layman as circumstantial. In many instances, however, as in The Reverend Mr. Taylor's case, it is far more picturesque and quite reliable.

Medical evidence for the prevalence of scurvy in the Mother Lode is not all as directly clinical as that of Praslow and Logan. Dr. Tyson[87] speaks of the miner's diseases which netted him a fortune in gold dust fees.‡ Even before he had completed his "Tent

* The so-called "City Hospital" was located on Clay Street and proclaimed as such by a sign in large red letters, but was actually a private hospital, housing 150 to 350 patients, including the "2 ward annex" 30x40 feet, in which 80 to 100 patients were being cared for as public charges. The city was then (1849) paying for the care of those patients at five dollars per day. Hospitals also had charge of burial, furnishing coffins at $10, e.g., in Sonora (as shown in the old records).

† Mrs. Taylor gave birth to a daughter, "Oceana", off the mouth of the Rio de la Plata, and "was hardly able to walk ashore, exhausted by the monstrous wear and tear of sea life and the wasting effects of chronic diarrhea."

‡ As his medicines gave out, Dr. Tyson says he put his empty bottles to good use, "filling them with gold dust." When he was leaving his hospital, giving up his lucrative practice, the physician relates that his horse, with saddle bags filled with these bottles, wandered away but was found. Laconically, he remarked: "I was glad I found my banker again."

and Arbor" Hospital, attended by a "cook and a steward" near Mormon Camp, he was busy seeing scorbutic patients. "Vegetables of any kind could not be had. A great deal of sickness prevailed and my services were in great demand. The principle diseases most afflicting the miners were scurvy, rheumatism, dysentery. Where the patients were brought under treatment soon after the attack, however, I did not, generally speaking, find their cases at all intractable."

Just as the emigrants on the Overland Trail held dried beans responsible for attacks of cholera, as Read[31] points out,* so were the salted meat provisions blamed for precipitating scurvy. They were regarded so dangerous to health that sides of salt pork were used as paving blocks, one writer reports, as a result of the scurvy epidemic in Sacramento. Repeating this "salt formula," Dr. Tyson continues:

> The exclusive use of dried and salted meats is highly prejudicial . . . some terrible cases of scurvy I witnessed from this cause, and much of the sickness at the mines results from inattention to this matter. In most of the severe cases of disease, and in many of the deaths which have occurred at the mines, a scorbutic habit prevailed along with the existing complaint. As this bad condition of the system can be so readily avoided, it was strange to me that it should be so prevalent. Men are apt to forget health and everything in the pursuit of gold.
>
> The use of a vegetable diet and fresh meat occasionally would be a protection from this scourge, but as such luxuries, except the latter at long intervals, could heretofore rarely be obtained in the mining districts, it becomes necessary to guard against it by the means suggested.

California's perishable foodstocks, other than meat on the hoof, were inadequate at the start of the influx of immigrants. When California's controversial, first Yankee "doctor," John Marsh,[56] arrived in Yerba Buena (the future San Francisco), he found only a "sandy stretch of barren soil, occupying one corner of the plaza, that had been a potato patch." The shortage of this staple was so marked, the Reverend John Todd,[84] D.D., recalls, that "as a rare luxury, a saloon, composed of cloth only, could now and then hang out the sign 'potatoes this day', and it was crowded."

Within five months after gold was first discovered† in the Sutter millrace in Coloma on 24 January 1848, and long before the news had reached the Eastern seaboard, a prophecy of impending short-

* "Many companies discarded their stores [of dried beans] not only to lighten their loads but as a precautionary health measure—the commanding officer of Fort Kearney had forbidden the issue of beans at that post on account of the danger of cholera."

† For the first year, 1848, mining was confined to those already on the scene, followed by Southern Californians, Sonoran Mexicans, Chileans and Peruvians—only coastwise journeys away—and the Utah Mormon and Oregon settlers, then by Australians.

ages in antiscorbutic fruits and vegetables was made. A letter, dated 11 June 1848 and attributed to Howard[38] of the San Francisco mercantile firm of Mellus and Howard, agents for the ship *California,* was dispatched to its owner Benjamin T. Reed in Boston.

> People here are perfectly crazy. This town has been almost deserted excepting by a few merchants who are now doing a very excellent business. Two vessels have left for the Islands (Hawaiian) and one leaves tomorrow for Valparaiso (by which this is forwar'd) for cargos principally of eatibles for the truth is that we shall be famished this year if produce is not brought from foreign ports, and, we may expect a very large emigration in the fall. . . .

Another "trader," this one a trained physician, Dr. Charles Frederick Winslow,[92] anticipated outbreaks of scurvy among the emigrants and requested immediate shipment of antiscorbutics from the East. Dr. Winslow had reached San Francisco in June 1849, "doubling in brass," as the saying went, by also representing the Henry Astor Company of Massachusetts as an adviser to arrange their California shipments. On 16 September 1849 the company's ship, the *Henry Astor,* arrived in San Francisco harbor, and under date of 20 September, Dr. Winslow advised his principals that, except for the death of its "Mr. Myrick and of some cases of scurvy, I can announce to you good news concerning every internal circumstance connected with her passage." Five days later he wrote: "In sending out provisions for the men send things that will be best against the scurvy, fever and ague. Canistered provisions and vegetables and all sorts of fruit are first rate but very expensive in this country." As for his medical practice, he reported that he had not lost a single case and that he expected to make $1,000 a month when his hospital was completed since "a consultation is $5, and a visit $8 near at hand. Hospital board and attendance is $10 per day."

The importation of fruit into San Francisco from the Hawaiian and Philippine Islands as well as the Society Islands (Tahiti) became a large-scale business venture and in one instance, at least, a royal monopoly. Franklin A. Buck,[10] a Bucksport County, Maine, youth came to California in 1849 with six companions, after his graduation from Phillips Academy at Andover, Massachusetts. In December 1850 he purchased an interest in the schooner *Columbia* to sail to the "Sandwich or Society Islands after a cargo of vegetables

and hogs." In a letter* written from Papeete on 11 March 1851 Buck tells of purchasing a cargo of perishables and hoping it "will sell for enough to pay for the charter of the schooner." The cargo consisted of: "400 barrels sweet potatoes, 200 squashes, 40 hogs, 35 fowls, 90 dozen eggs, 2,000 limes, 2,000 coconuts, 50 bunches bananas, 46,000 oranges." The latter, costing $5 a thousand, he had to purchase from forty-year-old Queen Pomari of Papeete who, he adds, "has become pious of late and instead of spreeing around the island as she used to, stays at home and speculates in oranges."

Buck landed his perishable cargo in San Francisco on 7 May 1851 after a month's delay in Hawaii to repair a gale-broken topmast and mainsail. This was a few days after fire had almost wiped out the town, and his cargo arrived when food stores were in great demand. About half of his 46,000 oranges were still sound. These he sold for $40 a thousand, netting a profit of $700. He fared even better with his sweet potatoes. He observed philosophically: "Never do grumble at what can be helped and at what can't be helped," when, incidentally, on the very day he landed his cargo, a Mexican trading vessel arrived with a cargo of cats which sold readily from $8 to $12 apiece.

Bayard Taylor,[82] the observing though not always conservative traveler-reporter, writing for James Gordon Bennett's *New York Herald*, corroborates the trading ventures of Buck and others. Taylor records that in 1849 San Francisco grocery stores displayed "huge piles of Sandwich Island squashes" so that a "dinner satisfying a moderate appetite could be had for $5," and "you may get an excellent beefsteak, scantily garnished with potatoes, and a cup of good coffee or chocolate, for $1, but milk, fruit and vegetables are classed as luxuries, and fresh butter is rarely heard of."

Only individual cases of scurvy, instead of "epidemics" are encountered after 1850. By that time Northern California had learned to absorb the emigrants who were still coming by sea and land. No longer did ten thousand arrivals within a month completely demolish slender foodstocks. The rain-drenched mountain paths of the winter of 1849 had dried out and many were broadened into roads which permitted trans-shipment of antiscorbutic perishables to the faraway camps. There were now regional and local stores and supply centers, whose owners prospered more than their gold mining customers. Many of them, operated by descendants, are

* Buck's letters, some 300 of them, are preserved by his maternal ancestors, the Sewell family, shipbuilders in Bath, Maine.

flourishing businesses today. Some grew to national proportions and importance. Many eastern and mid-western farmers, who had originally come to mine, tired of plying pick and shovel among the boulders of the creeks and returned to agricultural pursuits, raising foodstuffs in the soil not colored so deep as the gold-bearing earth of the Mother Lode itself. Later, they were to battle their erstwhile mining partners to preserve their farm lands from the ravages of hydraulic mining operations.

California's agricultural economy[33, 60] rapidly began righting itself,* both in the proximity of the mines and in the south, which, though lacking gold, was yet rich in resources of vine and grove. Its ranches of vast, Spanish-grant proportions were beginning to supply more than hides and "meat on the hoof." Graziers turned orchardists and multiplied their self-sufficient patio trees into groves, now that Captain Phineas Banning had established weekly coastal shipping schedules from San Pedro to San Francisco. Bills of lading for "boxes of oranges and lemons and skins of wine" bearing Banning's bold signature of the 1850's are too numerous to be collector's items.

By comparing the cases of scurvy listed in early hospital records[30] with those of other diseases and extrapolating them to the populations of the mining camps where no exact records were kept, one can conservatively estimate that 10,000 men died of scurvy, or its sequelae, in the California Gold Rush, half of them in the winters of 1848 and 1849, when scurvy raged like a contagious epidemic. Its victims outnumbered those of cholera. Unlike cholera, however, scurvy was a disease of man's own making because he ignored or disregarded the dietary measures that were for the most part already well established both in medical and in lay knowledge.

As one reads the first-hand accounts of scorbutic ravages, one is impressed, as was Potter[28] in his editing of the Geiger-Bryarly papers, that letters and diaries and journals written at the time are far more reliable sources of information, and therefore more valuable, in our *post-hoc* diagnoses of scurvy than are the reminiscent accounts, often written many years later, of Forty-niners, with their possible lapses of memory in recalling details. But these contemporary documents reveal why scurvy cannot be studied in the isola-

* In 1852 California was, for example, producing potatoes[2] in abundance and reported a crop of 1,393,170 bushels. By 1854 the state exported 25,543 sacks, of two bushels each, to Pacific ports, chiefly Australia, which was experiencing its own first "gold rush" at the time.

tion of the laboratory. The guinea pig in its sheltering cage yields only a partial picture of the disease, even when the animal is placed on the miner's diet of "salt horse and beans," as Ershoff[20] and the writer did, to determine the validity of the oft-expressed belief that salt contributed to "the scorbutic taint." They failed to influence the mortality rate of scorbutic guinea pigs with a 3 per cent supplement of sodium chloride to their diets. What was not done was to subject the animals to the stress of mind and body suffered by the Forty-niner.

The spectrum of scurvy is a broad one and lends itself to study in fields other than physiology, nutrition, histology, or clinical medicine. It is more than a story of medical bygones, interesting as historical romancing. When its gaunt finger makes an entry on the pages of a pioneer's diary or letter or in a physician's journal, it records social and economic as well as medical history.

These, then, are the stories of scurvy and of unprepared pioneering which parallel, as it were, the *veta madre*—California's Mother Lode—for the first few years that men sought her gold.

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Notes and Events

Edited by Dorothy M. Schullian, Ph.D.*

The Reception of William Beaumont's Discovery in England
Two Additional Early References

In his monograph, *The reception of William Beaumont's discovery in Europe* (New York, Schuman, 1942), Dr. George Rosen, as Dr. Genevieve Miller pointed out in her review (*Bull. Hist. Med.*, 1943, *13*, 111-13), underestimated the notice which was taken of Beaumont's work in Britain. In a subsequent article (*Bull. Hist. Med.*, 1943, *13*, 631-42) Rosen took account of the additional facts given by his reviewer but stressed the difference in character of the interest in Germany, where it was mainly physiological, from that in Britain, where the results of Beaumont's observations were used for clinical purposes or in the application to dietetics. No mention was made on that occasion, nor does the fact seem to have been noted since, that there are at least two other important English references to Beaumont's work dating from 1837, both highly favourable, and one of them from one of the leading English physiologists of the time.

Herbert Mayo's *Outlines of human physiology* (London, Renshaw, 1827 etc.) was the standard work on the subject in England, and each edition was kept up to date by extensive references to current research reported in both British and foreign literature. The fourth edition of this book (London, 1837) has an excellent account of Beaumont's work (pp. 511-23) with long quotations from his book, of which Mayo apparently had a copy with the Boston, 1834 imprint. Herbert Mayo (1796-1852) was a pupil of Sir Charles Bell, and his name became involved in the priority dispute with Bell and Magendie over the discovery of the functions of the trigeminal and facial nerves. He was professor of comparative anatomy at the Royal College of Surgeons, of which he was one of the 300 original Fellows, the first professor of anatomy at King's College, London, on its foundation in 1830 and later professor of physiology and pathological anatomy in the same college. More notably, he is regarded as the true founder of the Middlesex Hospital Medical School. That such an outstanding English physiologist and medical teacher immediately recognised the value of Beaumont's work is certainly a factor to be considered in Rosen's theory of relative influences.

The second reference to Beaumont is equally interesting, for it occurs in a book designed to spread medical and physiological knowledge among educated laymen. This was *The philosophy of health* (2 vols., London, C. Knight, 1836-7) by Thomas Southwood Smith, who has been called 'the intellectual father of the sanitary system' and who was at the time of the

* Cleveland, Ohio.

book's publication physician to the London Fever Hospital, the Eastern Dispensary, and the Jews' Hospital. A man of wide culture, Smith had been trained for and served in the nonconformist ministry before he took his M.D. at Edinburgh in 1816. He was a co-founder of the celebrated *Westminster Review,* the Useful Knowledge Society, the Health of Towns Association, and many similar bodies and it was he who supplied the proselytising zeal which made Chadwick's administrative reforms acceptable. That he should be so up to date in his reading as to include an account of Beaumont's work in a popular exposition of physiology (vol. ii, pp. 225-36) is characteristic of him.

These additional English references to Beaumont seem to strengthen the doubts of the validity of Rosen's thesis expressed by Dr. Miller. Using Rosen's own quantitative methods it could now fairly be stated that within five years of the publication of Beaumont's book there appeared in Britain an edition of the book itself and eight other references to it, while in Germany there were a translation and seven other references, which perhaps proves nothing except the pitfalls which lie in the use of statistical methods for making qualitative assessments.

F. N. L. POYNTER

A Note on William Harvey's "Nan Gunter" (1616)

In our article "William Harvey: his neurological and psychiatric observations" (this *Journal,* 1957, *12,* 126-39) we drew attention to the fact that Harvey was familiar with patients in whom mental illness was accompanied by apparent insensibility to pain. His earliest observations of this phenomenon are recorded in his MS. lecture notes *Prelectiones anatomiae universalis* (1616) in which occurs this passage:

> ". . . || Nan gunter &c. puto callum
> fecisse || the mad woman pins in her arme
> Mary pin her cross-cloth . . ."

In the transcript accompanying the autotype reproduction of the MS. edited by a committee of the Royal College of Physicians of London (London, Churchill, 1886, folio 11b) the double vertical lines in Harvey's MS. are omitted (as they are throughout the transcript), thus leaving the passage without punctuation and its sense obscure. "Gunter," printed without a capital initial in the transcript, was apparently not recognized as a surname, since it is stated in the introduction that "capital initials, which are sometimes absent in the manuscript, have been given in the transcript to all proper names" (*ibid.* p. v). We suggested that "Nan gunter" could only be a proper name and that therefore the surname should have a capital initial; and we hazarded the guess that the lady may have been a relative of Edmund Gunter (1581-1626), Professor of Astronomy at Gresham College,

which however we have not been able to confirm. But we have since found ample evidence that Harvey's "Nan gunter," or properly Anne Gunter, was indeed a *cause célèbre* of that time.

She was briefly mentioned by Thomas Fuller *(The church-history of Britain,* London, Williams, 1655, pp. 73/4) in his list of "Cheaters of several Kindes. . . . King *James* his dexterity in detecting them." The first detailed account we have been able to find was given by Thomas Guidott in his preface to the 3d and 4th editions of Edward Jorden's *A discourse of natural bathes, and mineral waters* (London and Bath, Salmon, 1669; London, Sawbridge, and Bath, Salmon, 1673).* Guidott's preface is essentially a short biographical sketch of Jorden's life, from which the following is taken:

Whilst he practised in *London* there was one *Anne Gunter,* troubled with such strange and unusual Symptomes, that she was generally thought and reported by all that saw her to be bewitch'd. King *James* hearing of it sent for her to *London,* and pretending great pitty to her, told her, he would take care for her relief, in which thing he employed Doctor *Jorden,* who, upon examination, reported to the King, that he thought it was a Cheat; and tincturing all she took with harmless things, made her believe that she had taken Physick, by the use of which, she said, she had found great benefit. The Doctor acquainting his Majesty that he had given her nothing of a medicinal nature, but only what did so appear to the Maid, and also, that though when he repeated the Lords Prayer, and Creed in English, she was much out of order, yet at the rehearsal of the same in Latine she was not concern'd, the King was confirmed in what he had suspected before, and the Doctor had suggested. Whereupon the King dealing very plainly with her, and commanding her to discover the Truth unto him, the maid, though at first very unwilling to disclose the Juggle, yet, upon the Kings importunity, and promise to her of making up what damage should accrue from the discovery, confessed all, and his Majesty received from her own mouth this Account. That sometime before there happened a difference between a Female Neighbour of her Fathers and himself, and having in his own apprehension, no better way to be avenged of her then this, impiously caused his Daughter, on the receiving of the Sacrament, to engage to imitate one bewitch'd, and ascribe it to that woman, which she did, and acted this part in so exact and wonderfull a manner, that she deceived all the Countrey where she lived, who thought it to be a truth. After which Confession she was very quiet, & the King giving her a Portion, she was afterwards married, being by this subtle artifice perfectly cured of her mimical Witchery.

In 1938 Cecil Henry L'Estrange Ewen *(Witchcraft in the Star Chamber,* London, for the author, pp. 28-36) published a summary of the Star Chamber papers (London, Public Record Office, St. Ch. 8, 4/10) which deal with her case and date from 1604 to 1607. Among the depositions are those of Edward Jorden and his wife in whose house she was lodged for a time when King James I had her brought to London in custody of Samuel Harsnett,

* Although called the 3d and 4th editions on their respective title pages, they are the 4th and 5th editions, three earlier editions of Jorden's book having appeared in London, 1631, 1632 and 1633. The spelling of Guidott's name with a double "t" follows *The Dictionary of National Biography.*

later Archbishop of York, who had had experience in exposing "pretended demoniacs."

The case of Anne Gunter is not only of intrinsic psychiatric interest but has historical importance because the depositions provide a vivid picture of contemporary attitudes to mental illness. Futhermore, detailed accounts of "royal" patients are rare. Doubtless one of the results of studying her was that King James modified the views on witchcraft which he had expressed in his book *Daemonologie, in forme of a dialogue* (Edinburgh, 1597; London, 1603). In the course of time this led to greater tolerance, if only because many supposed witches came to be regarded as frauds and imposters instead of genuine instruments of Satan. A full transcript of the Star Chamber papers is therefore being prepared.

To our knowledge no contemporary account was published: the question therefore remains how William Harvey came to hear of her.* Only few biographical details of his life during the relevant period are available. Little is known of his movements or activities between graduating M.D. at Padua in 1602 and his appointment as Physician to St. Bartholomew's Hospital in 1609, except that after four separate examinations between May 1603 and August 1604 he was admitted a candidate of the College of Physicians of London in October 1604; that he married one month later;† and that in 1607 he was elected a Fellow of the College. L. M. Payne has drawn our attention to letters from Harvey's father-in-law, Dr. Lancelot Browne, written in July 1605 (in the possession of the Marquis of Salisbury, Hatfield House) which suggest that Harvey was then dividing his time between London and Folkestone (see also L. M. Payne, this *Journal*, 1956, *11*, 342-3). Jorden himself practised in London at least until the beginning of 1612 when he moved to Bath; his last recorded attendance at a Comitia at the College of Physicians was on 29 December 1611. He must therefore have known Harvey personally from College meetings. Thus Jorden was present at the College in May 1607 when Harvey was elected a Fellow, and again in June the same year when he was admitted. Subsequently they sat together at College meetings in April, June, September, and December 1609, and on two occasions in December 1611. Harvey may even have been present at some of Jorden's examinations of Anne Gunter and so learnt the technique of such investigations, which he applied thirty years later when he was asked to superintend the examination of the Lancashire witches (J. H. Aveling, *Memorials of Harvey*, London, Churchill, 1875).

That Anne Gunter's case was widely known and discussed in the College is shown by the fact that six months after Harvey's admission as a candidate, the College was asked to examine and report on her. The minute recorded in the MS. Annals of 4 March 1604/5 reads: "The Bishop of London had recently written to the College asking for the opinion of our College with

* In this connection it is tantalising that the deposition of another William Harvey (1586-?), B.A., of Exeter College, Oxford, is preserved in the Star Chamber papers.

† From the parish of St. Martin's, Ludgate, in London (W. Munk, "Notae Harveianae," *St. Bart's Hosp. Rep.*, 1887, *23*, 1-12).

regard to a certain girl possessed of the devil. The College therefore considered that in order to search out the truth of the matter, certain doctors from the College should be sent to visit the girl: if after they had carefully noted all the facts and had considered all honest and convenient ways or means of investigating the truth, they found nothing but bare fiction and manifest pretence, then the opinion of the College would be that this girl had acted deceitfully and that everything was fraudulently made up and affected, and the Reverend Bishop of London would be informed accordingly. The three doctors chosen for this were Dr. Wilkinson, Dr. Dunne and Dr. Argent." This last was Dr. John Argent to whom Harvey addressed the second dedicatory epistle in *De motu cordis* as "President of the London College of Physicians and the writer's particular friend" (as translated by K. J. Franklin. Oxford, Blackwell, 1957, p. 5). It seems safe to assume that either he or Jorden or both discussed Anne Gunter with him. Moreover, if "Nan Gunter &c. puto callum fecisse" is translated as "I consider that Nan Gunter made herself insensitive to pain," it is justifiable to infer that Harvey spoke from personal knowledge and observation of the patient. That he spoke of her familiarly as "Nan" possibly supports this conclusion, as does the "&c." following her name, which implies either that he intended to relate details of her case in the course of his lecture, or that he intended mentioning other similar cases.

However that may be, it is certain that her illness made a great impression on him: perhaps it was she who first drew his attention to patients who showed disturbances of sensation accompanying mental illness, and so aroused his interest in the physiology of sensation as opposed to motion, a problem with which he was to be concerned all his life. His mention of other similar cases immediately following Nan Gunter—"the mad woman pins in her arme" and "Mary pin her cross-cloth"—confirms this. The brief note "Mary pin her cross-cloth" must mean a patient whose cross-cloth ("A linen cloth worn across the forehead—1699." *O.E.D.*) could be pinned to her skin without causing pain and so is similar to the patient whom Harvey "out of Curiosity, visited . . . sometimes" at St. Thomas's Hospital some 25 years later (R. A. Hunter and Ida Macalpine, *St. Bart's Hosp. J.*, 1956, *60*, 200-206). She was "a Maid of about eighteen Years of age, who, without the loss of motion, had so lost the sense of feeling in the external parts of her Body, that when he had, for tryal sake, pinn'd her Handkerchief to her bare Neck, she went up and down with it so pinn'd, without having any sense of what he had done to her" (Robert Boyle, *Some considerations touching the usefulnesse of experimental naturall philosophy*. Oxford, Davis, 1663. Part 2, pp. 72-3).

ACKNOWLEDGMENT

We thank Sir Harold Boldero, Registrar of the Royal College of Physicians of London, for permission to examine and quote from the Annals.

RICHARD A. HUNTER
IDA MACALPINE

A Note on John Locke

Kenneth Dewhurst, in his "Symposium on Trigeminal Neuralgia," (*Journal of the History of Medicine and Allied Sciences,* 1957, *12,* 24) points up, in passing, the fact that John Locke remained interested and active in physic after he himself said that he "meddles not with it."

Dewhurst cites as evidence that Locke was "called in consultation by King William III" in 1697/8. This incident, however, may refer to the summons from the King that winter which, as Maurice Cranston indicates in his new biography of Locke (Macmillan, New York, 1957), was for political purposes and not for the medical consultation which Locke reported it to be. There is, however, ample other evidence of the continued interest of Locke in medicine.

For example, on 27 December 1700, in a friendly letter, now in the British Museum, to Hans Sloane, Locke added the following final paragraph:

A Diabetes is a disease soe little frequent that yu will not think it strange that I should aske whether yu in yr great practise ever met with it yu will doe me the favour to tell me the pathognomonick signes of it & if yu have cured it or known it and yu will obleige me in instructing me in the methode [Sloane 4038, f. 113].

On 22 August 1701 another letter from Locke to Sloane contained only the following paragraph:

I have a patient here sick of the fever of this season, it seems not violent but I am told tis a sort yt is not easily got off I desire to know of yu what ye fevers in town are & what method yu find most succesfull in them I shall be obleiged by yr favour if yu will give me a word or two by tomorrows post & direct it for me to be left at Mr Harrisons in the Crown in Harlow [Sloane 4038, f. 221].

In the first of these letters Locke informed Sloane that, although he was then up and around, "soar legs . . . have . . . made me spend the greatest part of my time in bed," and that the "old evill of my brest . . . sits heavier upon me." The second of these letters (which is quoted also by Cranston, p. 453) was written just before Locke's sixty-ninth birthday and about three years before his death. The first four words of this second letter, therefore, can hardly mean that Locke took up a very active practice, although Cranston does assert that "Once back in Oates [Locke] was called upon to exercise his medical skill among the local cottagers."

In any case, it is clear that the philosopher, politician, economist, and scientist, remained also a physician almost to the very end.

DAVID L. COWEN

James Alban Ghibbes, 1611-1677

Contemporary representatives of the extensive Gibbs family, one of whom[1] is a cataloger at the National Library of Medicine and by a

[1] Miss Jane F. Gibbs.

pleasant coincidence has handled some of the volumes which are the subject of this note, would still find it necessary today to adjust the spelling of their name, as their forbear James Alban Ghibbes sometimes did, for readier pronunciation in Italy. The career of James Alban is set forth in some detail in the *Dictionary of National Biography*,[2] in Anthony Wood's *Athenae oxonienses*,[3] and in Thomas Warton's *The Life and Literary Remains of Ralph Bathurst*, M.D.[4] Suffice it to repeat here that he was born in Valognes of English Catholic parents, that he first saw England at the age of nine, that he lived more than thirty years in Italy at Padua, Rome, and Modena, and that the skill with which he set down lyric verses brought him greater fame in his own time and afterward than did his apparently quite distinguished medical talents. He wrote at least one medical work, *De medico libri tres*, which was modeled on Cicero's *De oratore;* readers who may know in what form and where it survives are urged to communicate with this department.

James Alban Ghibbes studied with Johann Vesling at Padua and composed in his honor flowing Alcaic strophes which were published in Vesling's *Syntagma anatomicum*.[5] In 1642 he had settled at Rome and was serving in a medical capacity at the Hospital of Santo Spirito, where John Evelyn visited him in 1644-45.[6] The *Diary* contains a description of the Hospital, based mainly however on printed sources available to Evelyn. At about this time, and doubtless also earlier and later, Ghibbes was providing himself with medical volumes. His interest included those of the century preceding his own. Three examples, with a record and film of one other, are preserved at the National Library of Medicine. All four, once bound together in parchment and preceded by a flyleaf (Fig. 1) on which he listed the contents, were accessioned as one volume on 29 January 1875. They are:

1. Dubois, Jacques, *Commentarius de mensibus mulierum et hominis generatione . . .*, Venetiis, apud Io. Franciscum Camotium, ad signum pyramidis, 1556. Its title page (Fig. 2) carries the inscriptions "Ex libris Jac. Albani Gibbesij in Romano S. Spiritus Nosocomio medici. 1642" and "Ex libris Jac. Gibbesij Angli 1643," its last leaf (F8, recto) the inscription "Ex

2 1921-22 reprint, 7, 1127-8.

3 Second edition, London, 1721, 2, *Fasti*, coll.185, 192-5.

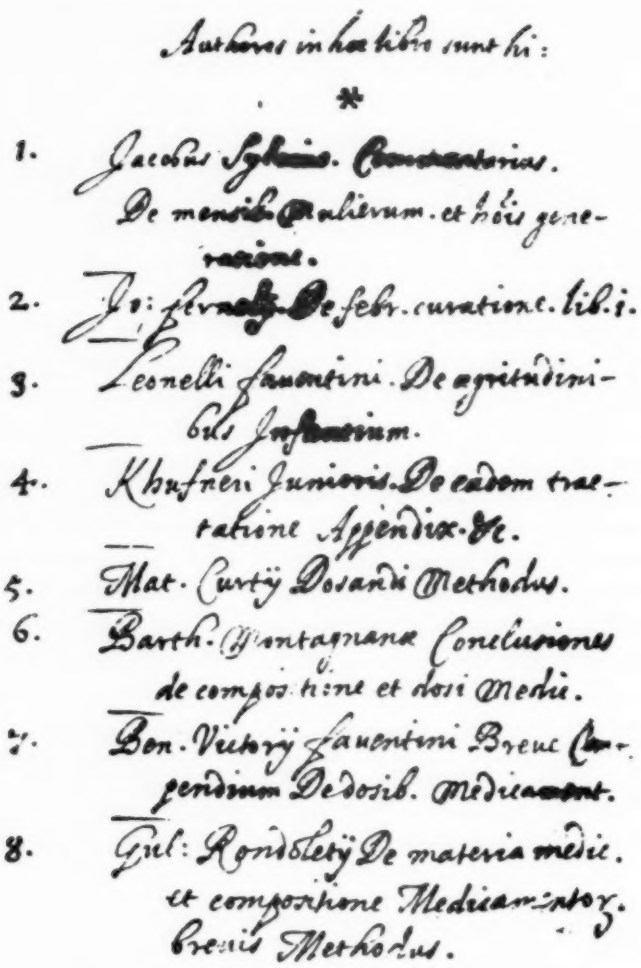
4 London, 1761, pp. xiv, 226-8 of first Arabic pagination, and 277-80 of second Arabic pagination. Verses to Ghibbes by M. Bacon appear in Sloane MS.396, f.14.

5 Folio NN4, recto, in the edition issued by Paulus Frambottus at Padua in 1647. They contain allusions to Diocles, Erasistratus, and Fabricius of Aquapendente.

6 See Evelyn's *Diary* for 5 November 1644 and 25 January 1645. Evelyn's remarks on Vesling, from Padua 31 July 1645 and October 1645-February 1646, will also be of interest to historians of medicine. The definitive edition of the *Diary* is of course the one published in 1956 in six volumes by the Oxford University Press and superbly edited, during more than twenty-five years of careful labor, by Mr. E. S. de Beer. For the purposes of this note, however, it has seemed gracious to use, in tribute to its former owner, the copy of the Bray-Wheatley edition, in four volumes, London and New York, 1906, which once belonged to Dr. Samuel C. Harvey (see the appreciation by Elizabeth H. Thomson in this Journal, 1954, 9, 1-8) and which appeared as no.489 in *Duplicates from the Yale Medical Library, List No. 6, April 1956*. In this copy Dr. Harvey had devotedly checked all passages bearing on the history of medicine. Those on Ghibbes appear in Volume I, pp. 117 and 171-2, those on Vesling in the same volume, pp. 254, 258, and 260-1.

libris Jac. Albani Gibbesij M.D. Romae. 1642." This item, with the flyleaf, was separated from the volume in 1946 and was rebound in red morocco in 1951.

2. Fernel, Jean, *De febrium curatione . . .*, Romae, apud haeredes Antonij Bladii, 1579. Its title page carries the inscription "Ex libris Iacobi


Authores in hac libro sunt hi:

*

1. Jacobus Sylvius. Commentarius. De morsib. Gallorum. et hoc generatione.
2. Jo: Fernelij. De febr. curatione. lib. i.
3. Leonelli Faventini. De aegritudinibus Infantium.
4. Khufneri Junioris. De eadem tractatione Appendix. de.
5. Mat. Curtij Dosandi Methodus.
6. Barth. Montagnana Conclusiones de compos: tione et dosi Medic.
7. Bon. Victorij Faventini Breue Compendium De dosib. Medicament.
8. Gul: Rondoletij De materia medic. et compositione Medicamentor. breuis Methodus.

FIG. 1.

Gibbesij Londnensis. 1644." There are marginalia (unfortunately cropped) throughout in the hand of Ghibbes, and on p. [7] he repeated "Ex libris Jac. Gibb . . . Angli." During at least one period of his ownership of this item signature B was misbound after signature C, for on f.A8, verso, at the catchword "acer," which should have carried to f.B1, recto, "acerrimam," he wrote, "Verte porro octo folia, atque invenies." Ghibbes may later have corrected himself the binding of this signature. This item was separated from the volume in 1946 and rebound in maroon morocco.

3 (his 3-4). Vittori, Leonello, *De aegritudinibus infantium tractatus,* with Küfner, Georg, *De eadem tractatione appendicula . . .* , Venetiis, ex officina Erasmiana Vincentij Valgrisij et Balthesaris Constantini . . . , 1557. This item was separated from the volume in 1946 and rebound in maroon morocco.

DE MENSIBVS
MVLIERVM,
ET HOMINIS
GENERATIONE,
IACOBI SILVII MEDICAE
rei apud Parrhisios interpretis
Regij,
Commentarius.

VENETIIS,
Apud Io. FRANCISCVM Camotium,
ad signum Pyramidis. M D LVI.

FIG. 2.

4 (his 5-8). Corti, Matteo, *Dosandi methodus,* with Montagnana, Bartolomeo, *Conclusiones de compositione et dosi medicamentorum,* Vittori, Benedetto, *Breve compendium de dosibus medicamentorum,* and Rondelet, Guillaume, *De materia medicinali et compositione medicamentorum brevis methodus,* Patavii, (per H. de Gibertis), 1556. This item was separated from the volume in 1946 and in 1951 was withdrawn as a duplicate. The Library's earlier copy of the item was accessioned on 9 June 1873.

Communications regarding other medical items from the library of James Alban Ghibbes will be gratefully received. It is probable that in many of his books he placed inscriptions similar to those in Items 1 and 2. His handwriting, which is distinctive and is well reproduced in Figures 1 and 2, will serve as identification for volumes in which he may have written marginalia without actually inscribing his name.

An Anglo-American Symposium On the History and Philosophy of Knowledge of the Brain and Its Functions

London, 15-17 July 1957

In December of 1956 Dr. H. W. Magoun, Professor of Anatomy at the University of California at Los Angeles, wrote to a number of people as follows:

"The several international congresses in the neurological, psychological, and psychiatric fields, which have been planned abroad during this coming summer, may be expected to provide an unusual opportunity for the association of professional scholars and enthusiastic amateurs interested in the historical development and philosophical aspects of these fields of knowledge. Because the existing programs will devote surprisingly little attention to these features, a number of persons have proposed that an attempt be made to arrange an ancillary meeting, concerned specifically with the history and philosophy of our knowledge of the brain and its functions. . . . Inquiry has already been initiated to determine whether the Maudsley Hospital, the Queen Square Hospital, and the Wellcome Historical Medical Library might be persuaded to serve jointly as hosts for such a meeting, with the sessions to be held in the Wellcome Library."

To this enquiry the Wellcome authorities responded promptly and generously, with the result that a most interesting Anglo-American symposium took place on 15, 16, and 17 July, the majority of the sessions being held in the auditorium of the Wellcome building on Euston Road. The group, which included representatives from Australia, Canada, France, Great Britain, Switzerland, the United States, and Uruguay, was welcomed by Mr. M. W. Perrin, Chairman of The Wellcome Foundation Ltd., and the exhibition was opened by His Excellency the American Ambassador, the Rt. Hon. John Hay Whitney. The various exhibits had been arranged by Drs. H. W. Magoun, Lawrence Kruger, Ilza Veith, Gordon Mestler, and Pearce Bailey, Sir Geoffrey Jefferson, Prof. E. G. T. Liddell, and Dr. E. Ashworth Underwood, Director of the Wellcome Historical Medical Museum and Library.

A reception by the Wellcome Foundation was held on the first evening. One session of the symposium was arranged at the National Hospital, Queen Square, followed by a luncheon at which members were guests of the Hospital, and there was a similar session and hospitality at the Maudsley

Hospital. The President and Fellows of the Royal College of Physicians entertained the members at a sherry party on 16 July. The final occasion was a dinner at Apothecaries' Hall at which Dr. Macdonald Critchley, Master of the Worshipful Society of Apothecaries (and Chairman of the London committee which organized the symposium), gave a brief history of the Hall and pointed out some of its treasures. Preceding this Sir Henry Dale, Chairman of the Wellcome Trust, had proposed a toast to Anglo-American co-operation in science and medicine to which Dr. Pearce Bailey, Director of the National Institute of Neurological Diseases and Blindness at Bethesda, Maryland, responded.

During the three days papers were presented by David H. M. Woollam, J. S. Wilkie, Ilza Veith, Macdonald Critchley, Denis Williams, Sir Russell Brain, Walter Pagel, Walther Riese, W. P. D. Wightman, E. H. Ackerknecht, Aubrey Lewis, G. W. Harris, H. McIlwain, Mary Brazier, Sir Francis Walshe, and Chandler Brooks. Dr. F. N. L. Poynter, Librarian of the Wellcome Historical Medical Library, to whom great credit is due for the admirable program and arrangements for this Anglo-American symposium, has informed us that the Wellcome Foundation is sponsoring the publication of the papers by Messrs. Blackwell of Oxford so that they may be available to a wider audience.

I. Bernard Cohen Awarded the Book Prize of the Institute of Early American History and Culture

On 4 May 1957 the book prize of the Institute of Early American History and Culture was awarded to I. Bernard Cohen, Associate Professor of the History of Science and General Education at Harvard, for his book entitled *Franklin and Newton. An Inquiry into Speculative Newtonian Experimental Science and Franklin's Work in Electricity as an Example Thereof*. Professor Cohen is well known to readers of this Journal as the Editor of *Isis*. His publications include *Benjamin Franklin's Experiments* and *Some Early Tools of American Science*.

The prize of five hundred dollars is given annually for the best book published in the field of early American history. The Institute, which is devoted to research and publication in this field, is sponsored jointly by the College of William and Mary and Colonial Williamsburg. Mr. Lester J. Cappon is Director. The citation which accompanied the presentation to Professor Cohen was as follows:

"American intellectual history is still a relatively new field, one in which the so-called definitive works are as yet uncommon. The appearance of I. Bernard Cohen's *Franklin and Newton*, offering splendid analysis of the scientific thought and achievements of Benjamin Franklin and of their relationship to the European world of science, is therefore an event of peculiar interest. It is proof that American intellectual history is fast reaching maturity. Certainly we may think of *Franklin and Newton* as authorita-

tive concerning Franklin's contribution to physical science, unquestionably major; and Professor Cohen's admirable description of thought in physical science in the eighteenth century Atlantic community also compels our admiration. With pleasure we hail the latest and remarkable achievement of Professor Cohen in his chosen field."

John B. Blake Accepts New Post

Dr. John B. Blake, formerly Lecturer in the History of Medicine and Public Health at the Yale University School of Medicine, has been appointed Associate Curator, Section of Medical History, at the Smithsonian Institution. Dr. Blake took up his duties in Washington, D. C., in June.

William Harvey Tercentenary Commemoration at Bethesda

Under the joint sponsorship of the National Heart Institute and the National Library of Medicine, and with the co-operation of the Public Health Service, U.S. Department of Health, Education, and Welfare, a commemoration of the tercentenary of William Harvey's death was held at the Clinical Center, National Institutes of Health, on 17 September 1957.

The morning session in the Auditorium was devoted to the historical aspects of the circulation of the blood; it included remarks by James Watt, Director, National Heart Institute; James A. Shannon, Director, National Institutes of Health; Frank B. Rogers, Director, National Library of Medicine; and papers by Charles Donald O'Malley on the pre-Harvey era, by Frederick G. Kilgour on Harvey's contributions, and by Chauncey D. Leake on the post-Harvey era. During this session the new color-film on Harvey was shown. The afternoon session was devoted to contemporary aspects of the circulation.

In connection with the commemoration, an extensive exhibit of Harveiana, including books written by predecessors of Harvey, by Harvey himself, by his opponents, and by his supporters, was opened in the lobby of the Clinical Center. A catalogue of the exhibit, with an historical introduction on Harvey's contribution, was prepared by Dr. Estelle Brodman. The exhibit remained at the Clinical Center through the month of September and will be shown also at the National Library of Medicine, the Smithsonian Institution, the Medical Museum of the Armed Forces Institute of Pathology, and the Georgetown University Medical School.

William Harvey at Bart's

Special mention here is certainly due the very interesting Harvey issue, June 1957, of *St. Bartholomew's Hospital Journal.* It contains the following articles in commemoration of the tercentenary of Harvey's death: Geoffrey Keynes, "William Harvey"; D. A. McDonald, "Harvey's influence on modern trends in circulatory research"; M. V. Stokes, "William Harvey at Bart's"; K. J. Franklin and G. du Boulay, "Variations on a theme of Har-

vey"; Gweneth Whitteridge, "Harvey's Galen"; John L. Thornton, "Writings on William Harvey by Bart's men"; R.B.B.P., "Harvey"; C. P. Wendell-Smith, "Harvey and embryology"; Richard A. Hunter and Ida Macalpine, "Dr. May's monster"; A. W. Franklin, "Some reflections occasioned by another Harvey tercentenary."

Tercentenary of the Founding of the Accademia del Cimento

The month of June, 1957, was notable also as marking the tercentenary of the founding of the great Accademia del Cimento at Florence by Leopold de' Medici, brother of the grand duke Ferdinand II. This renowned academy of science endured only ten years, but its contribution to experimentation is indicated by its motto "Provando e Riprovando" and was clearly set forth in the work *Saggi di naturali esperienze fatte nell' Accademia del Cimento* which it published at Florence in 1667. The work, a landmark in the history of science, was superbly reprinted in facsimile on the occasion of the tercentenary.

At the Domus Galilaeana in Pisa, under the presidency of Giovanni Polvani of the University of Milan, the following papers were delivered on 19 June in celebration of the tercentenary: G. Abetti, "L'Accademia del Cimento"; Maria Luisa Bonelli, "Gli strumenti superstiti dell'Accademia del Cimento" [now in the Museo di Storia della Scienza in Florence]; A. Procissi, "I manoscritti superstiti dell'Accademia del Cimento"; T. Derenzini, "Giovanni Alfonso Borelli, fisico"; Luigi Belloni, "Francesco Redi, biologo"; Bruno Nardi, "Significato del motto 'provando e riprovando.' "

Dedication of Medical Library, University of Kansas

The new building to house the Medical Library of the University of Kansas School of Medicine was dedicated at a convocation in Kansas City, Kansas, on 13 September 1957. Dr. Franklin P. Murphy, Chancellor of the University, announced that the University's Board of Regents had authorized the use of the designation "Logan Clendening Medical Library" for the new structure. Dr. Frank B. Rogers, Director of the National Library of Medicine, presented the dedicatory address entitled "Books and History" and Dr. Ralph H. Major, Professor Emeritus of the History of Medicine at the University of Kansas, presented the second lecture of the Clendening Lectureship, Eighth Series, on "Logan Clendening" in which Clendening's life as a medical educator and medical writer was described.

The new library, under the direction of Mr. G. S. T. Cavanagh, held open house for those assembled for the occasion. The structure is almost finished, although workmen are still applying finishing touches; since the building has not yet been accepted formally from the contractor, no books were in place. The library has been constructed to hold 120,000 volumes, and includes the library of the History of Medicine which formerly was

housed separate from the main library. The library also includes office and classroom space for the Department of the History of Medicine.

Dr. W. Clarke Wescoe, Dean of the School of Medicine, and Dr. William L. Valk, Chairman of the Library Committee, were recipients of congratulations on the successful completion of this long-planned project.

FRANK B. ROGERS

Addendum

Bruno Kisch in his valuable paper, "Iconographies of medical portraits" (*J. Hist. Med.*, 1957, *12*, 366-87), omits from his "trial" bibliography one of the best printed of all collections of medical portraits.

William Stirling's lavishly produced folio volume, entitled *Some Apostles of Physiology, being an Account of Their Lives and Labours. Labours that have Contributed to the Advancement of the Healing Art as well as to the Prevention of Disease,* was privately printed in London by Waterlow and Sons Limited in 1902 and was issued in connection with the visit of the British Medical Association to Manchester in that year. It contains 74 portraits, most of them beautifully reproduced. Eleven are full-page plates. The biographies are short.

Stirling was professor of physiology at Manchester University and a brilliant lecturer. He is mainly remembered as a showman, and this book is clearly the work of a great showman.

WILLIAM BROCKMAN

Book Reviews

GEORGE SARTON. *Galen of Pergamon.* (Logan Clendening Lectures on the History and Philosophy of Medicine, Third Series.) Lawrence, Kansas, University of Kansas Press, 1954. viii, 112 pp., 2 figs. $2.50.

Reviewed by JERRY W. STANNARD, *Instructor in Philosophy, Pennsylvania State University.*

THERE is great need of a comprehensive treatment of Galen's varied activities—physcian, scientist, and philosopher—in the context of contemporary social, political, and scientific affairs. Sarton's book, despite its small size, comes closer to filling this need than any work known to the reviewer.

Chapters I-IV supply the background necessary for understanding Galen's development, and, to some extent, allow us to see Galen as sharing in the virtues and defects of his time. (Chapter II contains an interesting study of Pergamon and its importance.) The primary concern, Galen the physician, is introduced in Chapter V by a summary of the main medical sects of Galen's day. Chapter VI, the weightiest of the book, discusses the development of anatomy and physiology, capped by a consideration of Galen's own contributions. Chapter VII treats of the related areas of medical practice—the arts of surgery and pharmacology. It is only in Chapter VIII that the other side of Galen is revealed—the philosopher and speculative thinker. Chapter IX may be described as a study of Galen's interesting personality and the various directions in which his eager mind led him. The last chapter, on Galen's influence, is followed by three appendices and an index.

In general, Sarton attempts to characterize briefly the main aspects of the Galenic system. This is accomplished by considering Galen's contributions to the several specialized fields in which he worked and whose prevailing patterns were, in many cases, crystallized by his teachings. Thus, e.g., Galenic anatomy is treated as the high point of classical anatomical studies. In this connection Sarton considers the relationship between Galen and his teachers, the opportunities Galen had in his early years for on-the-spot empirical observations of traumata, the subject of most of the Galenic dissections (the Barbary ape), the experiments which Galen did (and did not) make, and a brief survey of the special books which Galen devoted to the subjects of anatomy and physiology. This is all neatly connected by references to modern findings and methods, many of which Galen adumbrated. In this way one can appreciate why Galen had such an overwhelming influence on medical practice and theory up to the time of the Renaissance.

Undoubtedly the scope of the book prevented a more thorough examination of the nonmedical, i.e., philosophical aspect of the Galenic system. Yet the crux of Galenic scholarship is whether one can separate the medical from the nonmedical. A decision must be reached by every historian of science as to what constitutes greatness and lasting contributions to scientific

progress. Is it the mere assemblage of facts (empirical or otherwise) or the use made of the facts in some more comprehensive system? Galen, as well as our author, advocates the latter. But it is at precisely this point that philosophy contributed to the Galenic system—a conceptual framework.

Sarton's treatment of the detailed specialized problems in Greek science and medicine again demonstrates his unrivalled command of the material. There is room, to be sure, for some differences of opinion. Page 34, Galen's criticism of the Methodists, is made over-simple by stating that because they were atomists they "were probably Epicureans in other respects." It is noteworthy that Galen several times speaks highly of Soranus. The refutation of Chrysippus [p. 48] seems to refer to Chrysippus of Soli, the third head of the Old Stoa, and not Chrysippus of Cnidos. (Cf. H. von Arnim, *Stoicorum Veterum Fragmenta,* vol. II, fragments 894 and 903. These two persons were even confused by v. Arnim.) Frag. II, 880 [Tertullian *de anima* XV, 6] refers to Chrysippus the physician according to the latest editor of Tertullian, J. H. Waszink, *Tertullianus de anima,* Amsterdam, 1947, *ad loc.*) To call Aristotle "the first expounder of teleology" (p. 58) is to ignore the teachings of his master. One may well question whether Poseidonios (p. 71) wrote a commentary on the *Timaeus.* For a résumé of the problem see L. Edelstein (*American Journal of Philology,* 1936, *57,* 304, note 72).

The only serious omission in the bibliography is Karl Deichgräber, *Die Griechische Empirikerschule* (Berlin, Wiedmann, 1930: now available in photographic reproduction), which should do much to correct some erroneous impressions concerning Galen's "rationalism."

HENRY M. LEICESTER. *The Historical Background of Chemistry.* New York, John Wiley and Sons, Inc., 1956. viii, 260 pages, 15 illustrations, $6.00. $6.00.

Reviewed by AARON J. IHDE, *Department of Chemistry, University of Wisconsin, Madison, Wisconsin.*

THE title of this small volume is well chosen since the book surveys the development of the ideas which laid the background of modern chemistry. The author reveals a sound understanding of his subject and an appreciation of the influences which led to the growth of chemistry along the lines which it has taken. The treatment of the subject follows the traditional order, beginning with the chemical arts of antiquity, coming up through the alchemical period, examining the role of technology, medicine, and philosophy in the sixteenth and seventeenth centuries, and bringing the growth of chemistry itself just into the present century.

Dr. Leicester has chosen to emphasize background rather than contemporary status, ideas rather than factual knowledge. As a result, much more emphasis has been placed upon developments before Lavoisier than since (130 pages as compared to 111). In a short work of this type one wonders if a redistribution of emphasis might not have been desirable. For example, while there is a chapter dealing with Chinese alchemy (which

probably made no impact on Western alchemy), there is none on twentieth century chemistry. A few minor excursions in the chapters on radiochemistry and biochemistry touch on developments up to 1920 but there is no attempt to evaluate twentieth century chemistry beyond this. Further, by placing emphasis on the growth of ideas there is a failure to give proper appreciation to the importance of experimental chemistry as the foundation of ideas. It might also have been desirable to have brought out further the interplay between chemistry and industry during the nineteenth century.

A chapter of special interest is the one dealing with the growth of chemistry as a profession. We see here the shift of chemical activity from Paris to the German universities, following the pattern established when Liebig founded the Giessen Laboratory. The success of Liebig's system of instruction established a pattern for graduate study which came to be widely imitated in Europe and America. Simultaneous with this was the increasing use of chemists in the growing German chemical industry. Parallel developments of importance were the formation of chemical societies and the founding of chemical journals. By the end of the nineteenth century specialization had grown to the point where journals devoted solely to analytical, organic, biological, and physical chemistry were flourishing.

The reader who wants a brief survey will find this book to his liking. It is concise and closely reasoned and, within the scope of his objectives, the author has done an excellent job.

DONALD R. MCNEIL. *The Fight for Fluoridation.* New York, Oxford University Press, 1957. x, 241 pp. $5.00.

Reviewed by JOHN B. BLAKE, *Associate Curator, Division of Medical Sciences, United States National Museum, Smithsonian Institution, Washington, D. C.*

MORE than half a century ago, in 1901, Dr. Frederick S. McKay, a young dentist just moved to the Rocky Mountain area, noticed a peculiar discoloration of the teeth among the native population. "Colorado stain," as it was called, was well known to local dentists but had never been investigated. His curiosity aroused, Dr. McKay began a long search for the cause. For an up-to-the-hour (not minute: the New York hearing had yet to be held) review of many aspects of his search and the controversy that has resulted, one could not do better than read *The Fight for Fluoridation.* Competently written, well documented, and relatively nonpartisan in tone, Mr. McNeil's book is and will undoubtedly remain for some years a valuable addition to the literature on this subject, useful alike to historians and to those engaged in the thick of the battle.

In his search for the cause of "mottled enamel," McKay, aided by G. V. Black, showed that some geographical factor was involved and that the condition arose during the period of tooth formation. He early suggested, and in time became convinced, that the cause was something in water supplies—a popular belief—but could find nothing of significance by the

standard methods of chemical analysis of water then in use. For reasons not entirely clear, however, no one was persuaded to make an adequate study for trace elements until 1930, when Aluminum Company of America chemists, strictly for business reasons, ran a spectrographic analysis of the water supply of the town of Bauxite and found a high concentration of fluorine. Coincidentally, as it happened, two other groups of investigators, one in Arizona and the other in North Africa, were also implicating the same element.

With this knowledge, the U. S. Public Health Service and others took up the study of mottled enamel, further defining its epidemiological characteristics, and in particular its relation to decay. By 1945, city-wide controlled tests, which were expected to take ten years, were inaugurated in Michigan and New York. Except in Wisconsin, however, where a group of enthusiasts agitated for immediate and general fluoridation, professional, medical, dental, and public health groups maintained for some time a cautious attitude. But in 1950 favorable early returns in the test cities, no doubt reinforced by pressure from Wisconsin, induced first the Public Health Service and then the American Dental Association to endorse the measure.

As the demands for fluoridation increased, so did the opposition. At first it had been confined largely to cautious and skeptical scientists, but after the large professional groups had been won over, opponents of a new type became more prominent. A number of physicians and dentists remained unconvinced, but with them were mated such strange bedfellows as Christian Scientists, health-food faddists, naturopaths, and chiropracters, as well as those who charged that fluoridation was a Communist plot to soften the brains of Americans and prepare them for destruction.

Substantially, more than half the book is concerned with events since 1950. A few typical examples show the general pattern. They indicate clearly the composition of the leadership, the diverse nature of opposition elements, the difficulty of convincing an electorate of the merit of the proposal, and the inevitable political involvement when a debatable measure must be decided by elected public officials. As the title accurately indicates, the book is concerned with the *fight* for fluoridation. The author writes from the viewpoint of a general historian, rather than a scientist. While there is no doubt where his sympathies lie, he does not attempt to review or evaluate the scientific evidence for and against fluoridation, but rather reports in passing the scientists' conclusions because they are an integral part of the controversies he describes. This is all to the good: scientific reviews of public-health problems are published in profusion, but we are far from having too many accounts of how, within the conditions of our form of government, public-health measures are actually instituted.

Moreover, this book is thoroughly based on extensive manuscript and printed documentary sources, as well as personal interviews, in part because several of the leading spirits of fluoridation donated their papers and re-

print collections to the State Historical Society of Wisconsin. May their example inspire other men in the various fields of medicine to preserve their papers and make them available to historians.

MARIA ROOSEBOOM. *Microscopium*. Leyden (National Museum for the History of Science), 1956. 59 pp. $4.00.

Reviewed by MORRIS C. LEIKIND, *Medical Historian and Archivist, Armed Forces Institute of Pathology, Washington, D. C.*

THIS is an illustrated account of the development of the microscope. It is a beautiful book and every user of the microscope will want one for his own. The text is based largely on the collection in the National Museum for the History of Science in Leyden and the author of this monograph is the Curator of the Museum who is well known for her previous studies on the history of the microscope.

The book consists of ten sections, each dealing with the development of one aspect of the microscope. After an historical synopsis in tabular form which places the microscope in its setting in relation to economics, politics, philosophy and art, physics and chemistry, and biology and medicine from 1600 to 1900, the optical part of the microscope is described in some detail. The text is illustrated with vivid colored diagrams. Two sections, one on transmitted light, review the evolution of illumination systems in the microscope. After a section on simple microscopes, the author discusses briefly the microscope and medical science, sketching the history of the application of the early magnifying instruments to the solution of some of the basic problems of medicine and biology. Two more sections follow describing arrangements for focusing and the movement of the object with respect to the lens. The evolution of the stand and foot are then discussed; lastly, there are sections on the binocular microscope and on the phase contrast microscope.

The book concludes with a chronological outline of discoveries made with the aid of the optical microscope which are of importance for medical science.

In addition to many colored sketches and diagrams there are a number of magnificent full-page color plates of early microscopes. In this connection it should be mentioned that the European Branch of Charles Pfizer & Co. provided the funds which made this outstanding publication possible.

CAMILLE DREYFUS. *Some Milestones in the History of Hematology*. New York, Grune and Stratton, Inc., 1957. vi, 87 pp. $4.50.

Reviewed by STUART C. FINCH, *Assistant Professor of Medicine, Yale University School of Medicine.*

IN this interesting little book Dr. Dreyfus has abstracted and interpreted many of the outstanding scientific articles in classic medical literature which have helped to establish the field of hematology as a medical specialty. The

book is not intended to be a formal or organized historical review, and it is written in a rather informal, personal, and disjointed style. The first chapter deals with the history of the development of interest in the study of blood. The next three deal with the history of certain specific hematological disorders, and the final one is a biography of the life of Dr. George Hayem.

This book should be of interest to any person concerned with medical history, but particularly those who are interested in the field of hematology. One is impressed by the great progress in this field of hematology made by relatively unknown physicians during the last century who pursued their scientific endeavors against extremely adverse medical opinion. Dr. Dreyfus also has no reservations about quoting some of the published misconceptions and prejudices of a number of eminent scientists who were outstanding in other fields. A number of these men such as Trousseau and Magendie felt that clinical microscopy was a waste of time. Also well emphasized are the important contributions to the development of hematology made by scientists such as Ehrlich who are known principally for their work in other branches of medicine. The chapter devoted to the life of George Hayem is a fitting tribute to a man who made many profound contributions to the field of hematology. Chapters on the historical development of chronic hemolytic anemia, leukemia, and polycythemia vera complete the contents of this book. Although some of the material in these chapters is a bit repetitious, a number of interesting features about each disorder are included. The clinical features of each entity are firmly imprinted on one's mind through their historical association.

In the foreword to this short monograph Sir Lionel Whitby quotes Sir Winston Churchill: "The further one looked back, the more one could look forward." This remark certainly is pertinent to the advances made in the field of hematology during the past two centuries. It gives one great hope for the future.

HERMANN TRIEPEL. *Die anatomischen Namen; ihre Ableitung und Aussprache.* Fünfundzwansigste Auflage, vollig neu bearbeitet und entsprechend den neuen anatomischen Namen (Pariser N.A.) ergänzt von Robert Herrlinger. München, J. F. Bergmann, 1957. 82 pp. DM. 6.80.

Reviewed by THOMAS R. FORBES, *Associate Professor of Anatomy, Yale University School of Medicine.*

THIS is a useful compendium of Latin anatomical terms with their German equivalents. Included are Latin names from the latest *Nomina Anatomica,* the official list approved by the Sixth International Congress of Anatomists in Paris in July, 1955. Also supplied are the derivations of the Latin anatomical terms from Greek and Latin roots and, in some cases, short comments on the historical origins of the terms, e.g., *tendo calcaneus (Achillis), saphena, pia mater.* English-speaking medical students and physicians will be interested to discover the German forms of familiar anatomical names. This is a concise, well written, and pleasingly organized little book.

KARL ERNST VON BAER. *On the Genesis of the Ovum of Mammals and of Man.* Translated into English by Charles Donald O'Malley. . . . With an Introduction by I. Bernard Cohen. Cambridge, Massachusetts, History of Science Society, Inc., 1956. Reprinted from *Isis,* volume 47, pages 117-53. One plate. $1.00.

Reviewed by THOMAS R. FORBES, *Associate Professor of Anatomy, Yale University School of Medicine.*

HERE is an exciting episode in the history of embryology. Beginning at about the third week after fertilization, von Baer traces back to the ovum the development of the early canine fetus, comparing its history to that of the bird. Then he considers the formation of the mammalian ovum, and finally compares the latter with the ova of frogs, hens, snakes, crayfish, lizards, and other forms. Triumphantly he reports his first observation of the ovum and draws his fundamental conclusion: "Every animal which springs from the coition of male and female is developed from an ovum, and none from a simple, formative liquid."

Professor Cohen sets the historical stage with skill in his Introduction. Dr. O'Malley's translation is clear and readable. We are indebted to him for making easily available a work of the first importance in the record of biology's earlier days.

U.S. ARMY MEDICAL DEPARTMENT. *Preventive Medicine in World War II.* Edited by Col. John Boyd Coates, Jr., M.C. Volume II. *Environmental Hygiene.* Ebbe Curtis Hoff, Ed. Washington, D. C., Office of the Surgeon General, Department of the Army, 1955. vii, 404 pp. $3.50, illus.

Reviewed by EDWARD M. OPTON, *Research Assistant in Preventive Medicine, Yale University School of Medicine.*

THE series of historical volumes entitled *Preventive Medicine in World War II* is now extended to three. The first concerns epidemiology and the third deals with measures for personal health and immunization. It is the second, *Environmental Hygiene,* which is the subject of this review.

Wartime conditions are not always productive of careful records of compliance or noncompliance with directives and the consequences of such actions or neglects. Consequently, the bulk of material in this volume is in the nature of a statement of principles of health maintenance and the provisions of the Army regulations which are intended to implement them. The volume serves to acquaint the nonmilitary physician and sanitary engineer with the wide extent of the Medical Department's ordinary concerns and its relations with other governmental agencies, e.g., The United States Public Health Service.

There are nine chapters in the volume, to which five different authors have contributed. The two closing chapters (one on the subject of Quarantine and the other on Ports of Embarkation and persons in transit) go a bit beyond the assignment and are the more readable for it.

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